Province of British Columbia

Ministry of Agriculture

Government of Canada / Gouvernement du Canada

Regional Economic Expansion / Expansion Économique Régionale

Volume 1

REPORT

Overview Study of

WATER CONSTRAINTS IMPACTING AGRICULTURAL DEVELOPMENT IN BRITISH COLUMBIA

Project Number 271322, Subproject 4

under

CANADA-BRITISH COLUMBIA SUBSIDIARY AGREEMENT

ON AGRICULTURE AND RURAL DEVELOPMENT

TALISMAN
Land Resource Consultants
300-842 Thurlow St.
VANCOUVER B.C.
V6E 1W2

September, 1984

Canadian Cataloguing in Publication Data

Brisbin, Pat.

Overview study of water constraints impacting agricultural development in British Columbia

Co-published by Agriculture Canada.
"Project number 271322 Subproject 4 under Canada - British Columbia Subsidiary Agreement on Agriculture and Rural Development."
Written by Pat Brisbin and Dan Schroeter of Talisman Land Resource Consultants. Cf. p. 5.
Bibliography: p.
ISBN 0-7726-0265-4
Vol. 2 not published.

1. Water-supply, Agricultural - British Columbia. 2. Water in agriculture - British Columbia. I. Schroeter, Dan. II. Talisman Land Resource Consultants. III. British Columbia. Ministry of Agriculture and Food. IV. Canada. Agriculture Canada. V. Agriculture and Rural Development Subsidiary Agreement (Canada). VI. Title. VII. Title: Water constraints impacting agricultural development in British Columbia.

S494.5.W3B74 1985 631.7'09711 C85-092091-4

CONTENTS

1	INTRODUCTION	1
2	STUDY BACKGROUND AND METHODS	7
	Background	7
	Study Objectives	7
	Phase 1 Objectives	8
	Phase 2 Objectives	8
	Phase 1 Methods	9
	Report Information Sheet	9
	Literature Sources	9
	Literature Selection	10
	Input to Regional Workshops	11
	Cost Data	11
	Compilation Presentation	14
	Phase 2 Methods	15
	Overview of Water Constraints	15
	Regional Workshops	17
	Input from Water Management Authorities	19
	Compilation of Regional Inventory	20
	Costing of Regional Water Management Opportunities	20
	Other Considerations	21
3	RESULTS OF LITERATURE COMPILATION	23
	Objectives	23
	Report Information Sheets	23
	Cost Data	26
4	REGIONAL OVERVIEW OF WATER CONSTRAINTS	31
	Constraints Identified	31
	Overview Findings	32
	Island Region	32
	Mainland Region	33
	Okanagan Region	34
	Kootenay Region	35
	Thompson Region	36
	Cariboo Region	37
	Omineca Region	38
	Peace Region	40
	Provincial Summary	40
5	WATER MANAGEMENT OPPORTUNITIES	43
	Regional Workshops	43
	Contacts with Regional Agencies and Authorities	43

CONTENTS

	Mainland Region	44
	Island Region	45
	Okanagan Region	46
	Kootenay Region	47
	Thompson Region	48
	Cariboo Region	49
	Omineca Region	49
	Peace Region	50
	Comprehensiveness of Regional Inventories	50
	Regional Synopses	52
	Mainland Region	52
	Island Region	54
	Okanagan Region	60
	Kootenay Region	61
	Thompson Region	67
	Cariboo Region	68
	Omineca Region	71
	Peace Region	74
	Provincial Summary	75
	Regional (Off-farm) Works	75
	On-Farm Drainage	79
	On-Farm Irrigation	82
	Surface Water Erosion	84
6	PROGRAM OPPORTUNITIES	87
	Strategic Planning	87
	Research for Future Program Definition	90
	Integration with Other Programming	92
	Funding Criteria	93
	Maintenance Agreements	94
	Project Monitoring	95
REFERENCES		97
APPENDIX A:	TERMS OF REFERENCE	A1
APPENDIX B:	REPORT INFORMATION FORM	B1
APPENDIX C:	WATER MANAGEMENT OPPORTUNITY FORM	C1
APPENDIX D:	ARDSA PART III PROJECTS	D1

1
INTRODUCTION

This report and accompanying compendium constitute an overview study of the type, nature and extent of water-related constraints to agricultural development in B.C., and of potential opportunities to relieve these constraints through water management improvements.

This study arose in response to a request for proposal dated May 7, 1984 by Shawna Meade, Acting Head, Research Division, ARDA Branch, B.C. Ministry of Agriculture and Food (BCMAF) and in accordance with Terms of Reference attached to the request. Appendix A contains these Terms of Reference.

The study was coordinated by Farmland Resources Branch with the assistance of an inter-agency steering committee, comprised of representatives of the BCMAF, the B.C. Ministry of the Environment (BCME), and Agriculture Canada. The members of the steering committee included:

- Harvey Sasaki, P.Ag., Farmland Resources Branch, BCMAF, Chair
- Peter Wallin, ARDA Branch, BCMAF
- Ron Bertrand, P.Ag., Soils Branch, BCMAF
- John Metzger, P.Eng., Engineering Branch, BCMAF
- Dave Fuller, P.Eng., Water Management Branch, BCME

INTRODUCTION

- Wayne Ulrich, Agriculture Canada

The direction, advice and assistance provided by the steering committee is gratefully acknowledged.

This study also involved the participation of many other government personnel in compiling report summaries from the literature on water constraints and in attending workshops held throughout the province to discuss regional water management opportunities. All personnel involved are referenced in following report sections dealing with the literature compilation and the regional workshops. Their participation, on short notice and during a busy time of the year, was particularly appreciated.

In addition, the input received from various drainage and dyking commissions, irrigation districts and other water improvement agencies is gratefully acknowledged. A list of individuals and agencies contributing to the study is presented in a later section of this report.

The main findings of this study have been presented by the BCMAF's Agricultural Districts, which correspond to the district office areas of field operations staff. Figure 1.1 outlines these areas. For the purposes of summarizing findings on a broader regional basis, district office areas have been aggregated into 8 regions:

- Island: Duncan and Courtenay District Offices

- Mainland: Cloverdale, Abbotsford, and Chilliwack District Offices

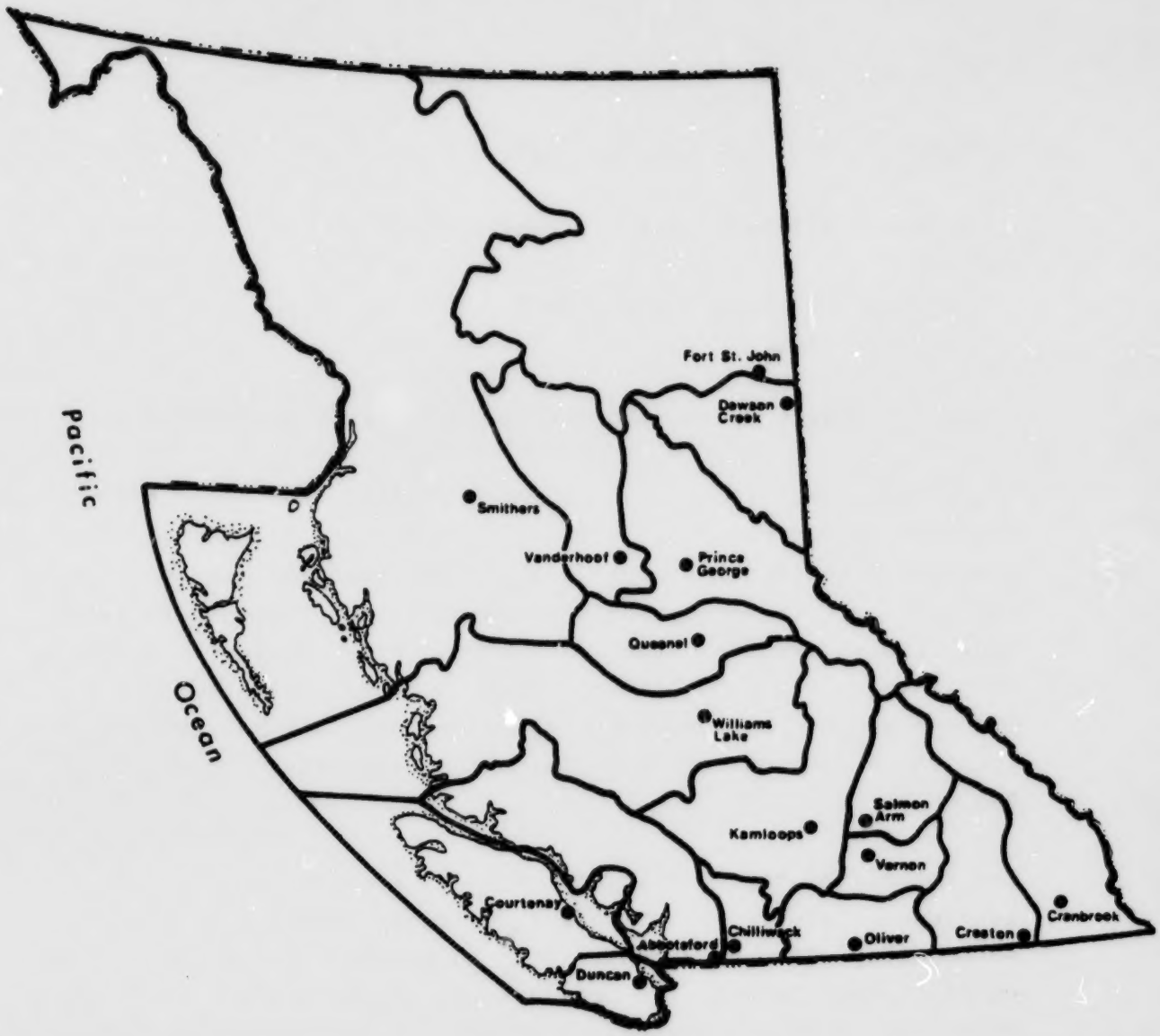

FIGURE 1.1

Agricultural District Office Areas

- Okanagan: Oliver, Vernon and Salmon Arm District Offices

- Kootenay: Creston and Cranbrook District Offices

- Thompson: Kamloops District Office

- Cariboo: Williams Lake District Office

- Omineca: Smithers, Vanderhoof, Prince George and Quesnel District Offices

- Peace: Dawson Creek and Fort St. John District Offices

These regions, in turn, can be related to the BCMAF's administrative regions, with the Island and Mainland Regions comprising the BCMAF's South Coastal Agricultural Region, the Okanagan and Kootenay Regions making up the Okanagan-Kootenay Agricultural Region, the Thompson and Cariboo Regions comprising the Thompson-Cariboo Agricultural Region, the Omineca Region constituting the Central Agricultural Region and the Peace Region coinciding with the Peace River Agricultural Region.

The following report (Volume 1) is presented in 5 major sections. Chapter 2 outlines study background, objectives and methodology. Chapter 3 summarizes the results of the literature compilation. Chapter 4 presents a broad overview of the magnitude of water constraints throughout the province, based on published land inventory statistics. Chapter 5 outlines the findings of the inventory of general and specific water management opportunities identified in the regional workshops and through input received from interested water management agencies. Chapter 6 discusses broad water management

programming needs and opportunities relative to the forthcoming federal-provincial agricultural development program. Volume 2 contains a compendium of background material collected for the literature compilation, as well as descriptions of specific water management opportunities identified during the study.

This report was written by Pat Brisbin, P.Eng., P.Ag., and Dan Schroeter, P.Ag., of Talisman Land Resource Consultants. While many of the findings and conclusions reached in this study are the product of input received from government personnel and others, final responsibility for the contents of the report rests with the authors.

2
STUDY BACKGROUND AND METHODS

BACKGROUND

The last federal-provincial agricultural development program expired in 1983. It is anticipated that a new agreement will be put in place in 1985. This study is one of several intended to assist in defining program needs and priorities for the new agreement.

STUDY OBJECTIVES

The purpose of this study is to define regional opportunities for agricultural expansion and enhancement through water management improvements designed to relieve water constraints to agricultural development. The study was conducted in two phases. Phase 1 consisted of a major compilation of water constraint literature of interest to the study. Phase 2 involved the compilation of a regional inventory of water constraints and specific water management opportunities.

STUDY BACKGROUND AND METHODS

Phase 1 Objectives

As outlined in the Terms of Reference, the objectives of Phase 1 were two-fold:

- to compile a bibliography of the literature on provincial water constraints and of specific projects or regional development plans proposed to alleviate such constraints

- to extract and compile information from these reports for use as an aid in establishing an overview inventory of water constraints in the province and for estimating the potential opportunities for alleviating such constraints, as well as the costs of doing so

Phase 2 Objectives

The Terms of Reference also outline the following objectives for the Phase 2 study program:

- to identify the type and areal extent of agricultural lands whose development is constrained by water management problems

- to provide an initial identification of the potential increase in the productive capabilities of these lands if the constraint is alleviated or removed, as well as an initial estimate of the costs of addressing the constraint

STUDY BACKGROUND AND METHODS

PHASE 1 METHODS

Report Information Sheet

The draft report information sheet provided in the Talisman proposal was reviewed and amended in an initial meeting of the Steering Committee with the Consultant on July 11, 1984. Copies of the finalized form were sent to potential sources of water constraint literature shortly thereafter by Farmland Resources Branch with a request for participation in the compilation and instructions for completing the forms. A copy of a the report information form is contained in Appendix B.

Literature Sources

Requests to carry out a compilation of water constraints literature were made to representatives of the Soils Branch, Engineering Branch, and ARDA Branch of the BCMAF, to the Water Management Branch of the BCME, and to Agriculture Canada. The time constraints of the study did not allow for literature compilations to be solicited from government agencies not immediately associated with the ARDSA program. This approach is not thought to have resulted in any major omissions in the literature search, in that most water management studies and reports prepared by or for other government agencies were done in conjunction with one or more of the agencies contacted and were available in their libraries. For example, reports associated with the Fraser River Flood Control Program of the Inland Waters Directorate of Environment Canada were available through the Water Management Branch.

STUDY BACKGROUND AND METHODS

Literature Selection

The enormity of the literature, coupled with the time constraints of the study, also required that the literature compilation be selective. Considering only the Lower Fraser Valley, south of the river from Delta to Hope, for example, a bibliography of water constraints literature prepared by the Water Management Branch lists 470 reports. In order to limit the literature review to those reports of greatest relevance to the study, several guidelines were suggested to report reviewers. Reports which identify constraints which remain in place today were indicated to be of the greatest interest. These include reports dealing with general inventories of water constraints or with proposed projects that have never been implemented. Reports dealing with projects implemented some time ago were indicated to be of little interest in that the water constraint has presumably been relieved and all cost estimates are too dated to be of much use to the current study. Reports dealing with projects that have been recently implemented were indicated to be of some interest to the extent that they provide baseline information on costs and projected benefits which can be transposed to other areas. However, even in these cases, the literature proved to be so extensive that agency reviewers were able to carry out only a sampling of the literature in the time frame afforded.

Reports dealing with site-specific areas with a limited areal extent (minor benefiting area) were also passed over in the literature review, unless the project was considered to be indicative of wider possibilities in the surrounding area.

STUDY BACKGROUND AND METHODS

Input to Regional Workshops

In most cases, completed report information sheets specific to a particular region were provided at or in advance of the corresponding regional workshop. In the case of report summaries dealing with projects not yet implemented, these provided one basis for identification and discussion of regional water management opportunities at the workshops.

Where the workshop identified a relevant report that had not been included in the literature review, a reviewer was assigned and a report information sheet was prepared subsequent to the workshop.

Cost Data

The Phase 1 literature compilation also collected information on capital costs associated with water management projects. This cost information was used to define the range of costs that may be associated with regional water management projects identified in the workshops, in cases where no project-specific cost estimate has yet been made.

Cost estimates were grouped by water management element (regional drainage, irrigation supply by type of source, flood protection etc.) and then updated to 1984 terms based on an 8% per annum cost inflation factor to 1982 and a 2% per annum factor thereafter. These cost escalation factors were set based on a review of several U.S. and Canadian construction cost indices and through discussions with Water Management Branch staff.

Adjusted total capital cost estimates were then converted to unit capital cost estimates by dividing total costs by the size of the benefiting area (the amount of arable land, in hectares, that would benefit from the project). Unit costs for all documented projects within each water mangement element were arranged in order of magnitude and the 50th and 90th percentiles of the range were computed. These two values were then used as the end points of a range of unit costs used to estimate the approximate costs that may be associated with water management opportunities identified in this study for which no recent cost estimates are available. The bias towards the upper range of past engineering cost estimates was selected because of the perceived nature of projects included in the cost studies compared to those identified in the regional inventory work for which no engineering studies and cost estimates have been carried out. To a large exent, the cost studies used are for projects that have been shown to have favourable economic outlooks (including many which have been implemented because of this) or are otherwise considered to be among the "better" projects available for implementation. Conversely, projects included in the regional inventory which have not yet been assessed in any engineering or cost studies include a high proportion of projects suspected of being relatively costly compared to projects of a similar nature that have already been implemented.

It could be argued that the cost range used is too low for some of these projects and that it would be more appropriate to use unit costs much higher than any of those estimated for projects included in the literature compilation. However, because an attempt was made in the regional inventory work to limit the identification of regional water management opportunities to projects that were thought to offer a reasonable development

chance within the context of likely economic conditions over the next ten years or so, the 50-90 percentile cost range was considered acceptable.

The 90th rather than the 100th percentile was used to define the upper end of the cost range in order to eliminate undue distortion caused by extraordinarily higher unit costs associated with one or two projects included in the literature review for each water management element. While this methodology resulted in quite large ranges for some water management elements, they reflect the variation in actual cost estimates for specific projects. To the extent that the upper range of unit costs for these specific projects can be considered representative of the costs of similar water management opportunities these cost ranges are useful and valid for an overview analysis of the type carried out in this study. It is stressed, however, that this methodology is not appropriate for estimating the costs or making funding decisions relative to any specific water management opportunity.

The above methodology was used for estimating unit costs of regional (off-farm) works only. On-farm drainage costs are not as variable, and were estimated in consultation with staff of the Engineering and Soils Branches of the BCMAF. For such works, it was considered acceptable to assign only an average unit cost estimate, based on observed costs of past on-farm works, updated to 1984 tenure. Unit costs for on-farm irrigation systems will vary considerably, depending on site conditions and on the type of system. A range of unit costs for on-farm irrigation works was therefore used, and this range was defined in consultation with staff of the BCMAF Engineering Branch.

STUDY BACKGROUND AND METHODS

All of the cost estimates produced in this study are only intended as a preliminary indication of total possible costs associated with the identified water management opportunities and are not meant to be used to assess the desirability of specific, individual project opportunities. They are based on past cost estimates which do not necessarily reflect actual construction costs and are for projects that may or may not be representative. Not even preliminary engineering estimates have been carried out for most of the water management opportunities identified in the regional inventories. Care must be exercised in the interpretation of the cost data produced for these projects. No attempt should be made to use the unit costs derived in this report to estimate the costs of specific projects.

Compilation Presentation

After all report information sheets were received they were sorted by agricultural region and district office. Because many of the reports reviewed related to more than one type of water management element, they have not been sorted by water constraint type. All report information sheets were assigned a reference number, copied, and then bound into the first section of the compendium that accompanies this report.

STUDY BACKGROUND AND METHODS

PHASE 2 METHODS

Overview of Water Constraints

A program of computerizing soils and agricultural capability mapping has been commenced which will eventually permit the identification of map-specific aggregates of any desired combination of soils/capability attributes. Unfortunately, this program has not progressed far enough to provide comprehensive regional information on soils/capability parameters related to water constraints. However, some regional land inventory data has been tabulated in past programs and can be used to provide very general overviews of regional water constraints throughout B.C. The data bases available for this purpose include:

- tabular summaries produced by ARDA Project 89077 in the report Agricultural Land Capability in British Columbia (BC ELUC Secretariat, 1976). This report summarizes the extents of improved and unimproved land capability classes for all lands classified by the original B.C. Land Inventory (BCLI). Summaries are available by Regional District (Census Division) and by the former 9 Agricultural Reporting Regions.

- tabular summaries produced by Talisman for the Select Standing Committee on Agriculture (SSCA), for the former 9 Agricultural Reporting Regions, of BCLI land capability class by present land use, for all Agricultural Land Reserve areas in the province. In areas of dual ratings the rating selected by regional workshops as most applicable or relevant was entered in the tabulation. These summaries are documented in the report Inventory of Agricultural Land Reserves in British Columbia (SSCA, 1978).

- tabular summaries produced by Talisman for ARDSA, for the present 8 Agriculture Regions and for all Regional District areas, based on the SSCA data described above. These summaries are presented in the B.C. Land Inventory Report (Talisman, 1979).

These data bases, plus several other reports providing additional data on water constraints in specific regions, were reviewed and overview descriptions of the extent and nature of regional water constraints were derived. These descriptions are largely based on BCLI data, notably the shift in the tabulated extent of class 1-4 or class 1-5 lands between unimproved and improved classifications within each region. In the water deficit regions of the province, this shift is largely due to land capability improvements that would be associated with irrigation. In the other regions of the province, this shift is related to potential drainage improvements.

While of some use in assessing the relative magnitude of regional water constraints, this approach has four major drawbacks. Most importantly, it does not relate the indicated water constraints to opportunities for water management. For example, extensive areas of the Southern Interior are constrained by moisture deficits and would improve with irrigation but no source of potential irrigation water is available. Secondly, this approach misses any water constraints associated with potential crop productivity enhancement that does not involve any shift in capability class. Thirdly, this approach is unable to provide any indication of the extent of water constraints that have already been relieved through completed water management development. Fourthly, this approach, while addressing water constraints related to irrigation and drainage, does not provide any information

regarding flooding and erosion constraints and improvement opportunities.

Regional Workshops

To partially overcome the deficiencies in the above approach and to provide for a more useful identification of regional water constraints that could be relieved by water management works, a program of regional workshops was held throughout the province. These workshops were attended by federal and provincial agency staff knowledgeable of each region's land and water resources. Staff attending were drawn from the Regional Extension Services Branch, Soils Branch, Agricultural Engineering Branch, ARDA Branch and the Farmland Resources Branch of the BCMAF, the Water Management Branch and Surveys and Resource Mapping Branch of the BCME, and from the Regional Development Branch and the Research Branch of Agriculture Canada.

While workshop format was altered somewhat from region to region to suit regional differences in the type and extent of water constraints as well as the experience and knowledge of workshop participants, the basic format consisted of a systematic consideration of all ALR lands within each region. The original, hand-coloured SSCA 1:50 000 working maps were used a a focus for workshop discussions. These maps portray land use as of the mid-1970's, major land tenure features (Indian Reserves, Forest Reserves, Parks etc.), and BCLI ratings for all ALR lands. Using these maps, workshop participants reviewed existing agricultural development and outlined water constraints and water management opportunities that they were aware of because of their work or other

experience in the area. All Phase 1 report summaries of projects not yet implemented were identified on the map sheets and discussed by workshop participants knowledgeable of the proposed works. These working maps were compiled by Talisman Land Resource Consultants for the SSCA and are retained on file at Talisman's Vancouver office.

Workshop participants were requested to identify all water management opportunities of relevance to potential agricultural development over the next 10 years or so. Areas of water constraints which did not offer water management opportunities because of technical infeasibility (eg. no irrigation water available) or economic viability (i.e. far too costly to be considered within the economic conditions likely to prevail in the next 10 years or so) were not included in this regional inventory. This decision was taken in order to ensure that the study produced useable results of immediate planning relevance for forthcoming agricultural development programming. Water constraints with little or no chance of being relieved through the provision of water development works are of limited interest in this context.

Whenever workshop participants identified a water management opportunity that was considered appropriate for inclusion in the regional inventory, an attempt was made to define it as highly as possible, with an indication sought as to map location, extent of potentially benefiting area, nature of potential cropping benefits, and relative magnitude of unit costs. To provide for some degree of consistency in the description of these opportunities, this information was

recorded on a standardized description form. Appendix C contains a copy of the form used.

In many cases, particularly those where no engineering or other studies had been carried out, little was known about the opportunity other than its general location, and it was not possible to be highly specific in the description. The major unknown in these instances was the potential project's relative costs, although in most cases the consensus opinion was that costs were high. In this situation it was often very difficult to determine whether a project should be included in the inventory or not. These decisions were generally left up to the workshop, although input was provided by workshop organizers on the approach used in other workshops. Most of these decisions centered around pumping heights and distances from available water in main-stem rivers, and the use of irrigation in areas with only minor water deficits.

For most of the water management opportunities which were identified during the workshops, the general geographical location of benefiting areas were outlined on 1:50 000 prints of the working maps, and the appropriate map number or numbers entered on the water management opportunities sheets. These maps are now on file in the Victoria office of the BCMAF.

Input From Water Management Authorities

Input was also solicited from all irrigation districts and drainage and dyking commissions in the province regarding perceived water management opportunities within their jurisdictions. In some cases this input resulted in the identification of additional water management opportunities not

defined in the regional workshops. Where approriate, these additional opportunities were added to the regional inventory of possible water-related projects.

Compilation of Regional Inventory

All water management opportunities identified in the above process of workshops and consultation were recorded on the standardized description sheets (Appendix C), sorted by agricultural district and assigned a reference number. These sheets were copied and bound into the second half of the compendium that accompanies this report.

Costing of Regional Water Management Opportunities

All identified water management opportunities were costed based on previous cost estimates, where recent cost studies were available, or through the use of unit cost ranges developed from the Phase 1 literature compilation, where no project cost estimates were documented. For the latter project opportunities, unit cost estimates were applied against district totals for potential benefiting areas rather than for individual projects. All cost estimates were tabulated by district and by water management element, and corresponding regional and provincial aggregates calculated.

All cost estimates were updated to 1984 terms using the cost escalation factors outlined in an earlier section of this report.

Other Considerations

This study sparked a great deal of interest among its various participants. Wide-ranging debate and discussion concerning the role that future agricultural development programming could or should take relative to perceived regional opportunities were common at most of the workshops. Much of this discussion went beyond the terms of reference of this study. However, as many of the points raised in these broader discussions are of potential value to program planners and because the authors of this report, along with the Chairman of the Steering Committee, were the only participants attending all of the workshops, a summary of the salient points to come out of these discussions is included in Chapter 6 of this report.

3
RESULTS OF LITERATURE COMPILATION

OBJECTIVES

The objectives of the literature compilation phase of the study were to compile a bibliography of the literature on provincial water constraints to agricultural development, and of specific projects or regional development plans proposed to alleviate such constraints, and to extract and compile information to help in establishing an overview inventory of water constraints along with information on potential opportunities for alleviating such constraints and the costs of doing so.

REPORT INFORMATION SHEETS

Requests to provide review information on water constraints literature were made to representatives of the Engineering, Soils, and ARDA Branches of the BCMAF, to the Water Management Branch of the BCME and to Agriculture Canada. Reviewers were asked to complete report information sheets (a sample copy of which is contained in Appendix B) on reports pertaining to water constraints to agricultural development. Guidelines (discussed in Chapter 2) were suggested to report reviewers in

order to limit reviews to those reports of greatest relevance to the study.

A total of 54 completed, or partially complete, report information sheets were received from reviewers. Of this total 11 represented regional drainage projects, 24 were for regional irrigation projects, 6 related to flood control and streambank protection projects, and 13 represented more general water constraint topics (such as appraisals of fisheries resources, appraisal of regional water resources, soil and water research programs, and strategic plans). Of the 41 which represented more specific projects, 12 covered completed or nearly completed projects, 17 represented current water management opportunities, and the other 11 either represented a second report dealing with a project already presented or covered a project which was considered not to be a current agricultural water management opportunity. This information is summarized, by region, in Table 3.1

The following people provided report information sheets, and their assistance in this regard is gratefully acknowledged:

- Jack Eby, BCME, Water Management Branch, Victoria
- Mike Currie, BCME, Water Management Branch, Surrey
- Ivan Velisek, BCME, Water Management Branch, Nelson
- John Metzger, BCMAF, Engineering Branch, Abbotsford
- Ted Vander Gulik, BCMAF, Engineering Branch, Abbotsford
- Erich Schulz, BCMAF, Engineering Branch, Victoria
- R.C. Wood, BCMAF, Soils Branch, Cloverdale
- L. Dutta, Fisheries & Oceans Canada, Field Services Branch, Vancouver

Table 3.1

WATER CONSTRAINTS STUDY
LITERATURE COMPILATION STATISTICS

REGION	NO. OF REVIEWS	REVIEWS BY TYPE OF PROJECT WORKS				REVIEWS BY STATUS	
		DRAINAGE	REGIONAL IRRIGATION	FLOOD/BANK PROTECTION	OTHER	WATER MGMNT OPPORTUNITY	COMPLETED PROJECT
Mainland	14	6(a)	0	3	5	1	6
Island	10	5	3	0	2	6	2
Okanagan	6	0	6	0	0	4	2
Kootenay	16	0	9	3	4	2	1
Thompson	7	0	5	0	2	3	1
Cariboo	1	0	1	0	0	1	0
TOTAL	54	11	24	6	13	17	12

(a) 4 of these represented regional irrigation works in conjunction with regional drainage works.

RESULTS OF LITERATURE COMPILATION

In addition to these report information sheets, two lists of reports were received from the Water Management Branch, BCME:

- a list of project reports pertaining to flood control, drainage, bank protection and other water related problems for areas on the south side of the Fraser River from Delta to Hope (prepared by the Victoria office)

- a list of Inventory and Engineering Branch library reports pertinent to the Victoria, Duncan and Courtenay water precincts, as well as a short list of general water-related reports (prepared by the Nanaimo office)

Copies of the report information sheets and two lists mentioned above are contained in the first section of the compendium which accompanies this report.

COST DATA

Capital cost estimates associated with water management projects collected during the literature compilation phase and the capital costs of projects which were funded under the previous ARDSA program (a summary of which is contained in appendix D) were updated to 1984 dollars and then compiled to define a range of unit costs that might be associated with those regional water management projects identified in the workshops for which no project-specific cost estimates have yet been made.

A total of 56 data sources were used in defining ranges of capital costs used in this study. Of this, 39 sources represented actual or budgetted expenditures for projects

funded under the most recent ARDSA program, 13 represented capital costs estimated as part of an ARDSA feasibility study and 4 represented costs from other studies not funded by ARDSA.

Unit costs were compiled separately for regional drainage, regional irrigation, and flood control/streambank protection projects.

Regional drainage cost data from 23 sources, representing a range of costs from $273 to $7583 per ha with an average cost of $1631 per ha, were used to define a cost range, using the 50th and 90th percentiles of the 23 data, of $802 to $2666 per ha for use in this study.

Regional irrigation cost data from 31 sources, representing a range from $425 to $10771 per ha with an average cost of $3207 per ha, were used to define a cost range of $2201 to $5867 per ha for use in this study. Separate cost ranges were developed for potential projects utilizing various sources of irrigation water; surface water without storage ($3085 to $5067 per ha), surface water with storage works ($2201 to $5867 per ha), groundwater ($3196 to $3824 per ha), and for potential projects with a combination of or as yet undefined source ($2845 to $5279 per ha).

Only 2 sources of data, $1267 and $1836 per ha, were used to define a cost range of $1552 to $1779 per ha for flood control and streambank protection projects.

Average unit costs for on-farm drainage and irrigation works were estimated in consultation with staff of the Engineering and Soils Branches of the BCMAF. On-farm drainage costs were established based on a 1984 cost of $1.80/m of installed

drains. At an assumed average drain spacing of 15 m, this translates to a cost of approximately $1200/ha.

Unit on-farm irrigation costs vary considerably, from approximately $600 to $3700/ha, with site conditions and the type of system.

The costs of on-farm wetland development in the Cariboo Region were estimated separately. The unit costs of such works are estimated to range between $250-400/ha.

The methodology used in compiling the cost data is discussed in Chapter 2, and the results are summarized in Table 3.2.

It should be noted that the costs considered in this study are capital costs only (costs associated with construction and engineering) and do not include any operation and maintenance costs, opportunity costs or externality costs.

Table 3.2

WATER CONSTRAINTS STUDY
REPRESENTATIVE WATER MANAGEMENT COSTS

(1984 $/benefiting ha)

WATER MANAGEMENT ELEMENT	NO. OF DATA SOURCES	RANGE OF COST ESTIMATES	AVERAGE COST(a)	50-90 PERCENTILE
regional drainage	23	273-7583	1631	802-2666
irrigation water supply				
- surface w/o storage	15	797-10771	3558	3085-5067
- surface with storage	12	425-7165	2732	2201-5867
- groundwater	4	2722-4163	3319	3196-3824
- unknown/combination	31	425-10771	3207	2854-5279
flood/streambank protection	2	1267-1836	1552	1552-1779
on-farm works				
- drainage	-	-	1200	-
- irrigation	-	600-3200	1500	-
- wetland development	-	250-400	-	-

(a) average costs are the arithmetic average of the unit (per hectare) costs of the data sources used; costs were not weighted in any way.

4

REGIONAL OVERVIEW OF WATER CONSTRAINTS

CONSTRAINTS IDENTIFIED

The following sections provide general overviews of the extent and nature of regional water contraints. As outlined in the Chapter 2 discussion of methodology, these regional overviews are based on available tabulated land inventory data and do not provide any indication of whether the water constraints have already been addressed (through past water management developments) or, if still outstanding, whether they are technically or economically feasible to address. Specific opportunities to relieve water constraints are outlined in the next chapter.

The available land inventory data also do not permit identification of all areas of land with water constraints related to water deficits and/or drainage problems, nor do they permit the identification of the extent of lands constrained by flooding or erosion. Nevertheless, the following overviews are useful in providing broad pictures of the magnitude and type of water constraints associated with the agricultural land base of each of the province's major agricultural regions.

REGIONAL OVERVIEW OF WATER CONSTRAINTS

OVERVIEW FINDINGS

Island Region

The 1976 ARDA report Agricultural Land Capability in British Columbia indicates that approximately 79,000 ha of Island Region lands classified by the original BCLI program as unimproved Class 5 would improve one or more capability classes if irrigation and/or drainage was provided. As well, minor amounts of Class 6 and 7 lands could be improved to Class 5 or better if drainage was provided. These estimates do not address potential irrigation and drainage improvements within an additional 116,000 ha of Island Region lands rated unimproved Class 2-4. However, analysis of the tabulated extents of agricultural land by unimproved and improved capability class suggests that no more than 87,000 ha of this land would improve with drainage and irrigation, and it is likely that the amount of land that actually has been classified as having improvement potential is much less than this.

In total, for the Island Region, the tabulated land inventory data suggest that between 79,000 and 166,000 ha of agricultural lands have improvement potential related to irrigation and drainage. Because BCLI assigned both irrigated and drained ratings on the Island, it is not possible to estimate which portions of the above amount require irrigation, drainage or both. However, since most of eastern Vancouver Island incurs a climatic moisture deficit, it has been assumed that the majority of these lands would improve with irrigation. A portion of this area will also require drainage, although, it is not possible to provide an estimate from available data. However, the 1978 SSCA report Inventory of Agricultural Land Reserves in British Columbia indicates that there are 4510 ha

of wetlands (defined as organic soils, or organic soils in combination with mineral soils) within the ALR lands of the Island and most of these would fall within the lands identified above. In addition, many areas of mineral soils would also benefit from drainage.

All of the above figures are based on the original BCLI land inventory mapping on Vancouver Island. This inventory data is being superceded by more detailed mapping of soils and agricultural capability. However this new program is not complete and it is not yet possible to obtain tabulated results of the new inventory for the entire region.

Mainland Region

The 1976 ARDA report indicates that approximately 17,000 ha of Mainland Region lands classified by the original BCLI program as unimproved Class 5 would improve one or more capability classes if drainage was provided. In addition, at least 3500 ha of lands rated as unimproved Class 2 would improve to Class 1 if drainage improvements were implemented. These estimates do not address potential irrigation and drainage improvements within an additional 148,000 ha of lands rated unimproved Class 2-4. Analysis of the tabulated extents of agricultural land by unimproved and improved capability class suggests that no more than 12,500 ha of this land has been classified as improving with drainage. However, because not all poorly drained agricultural lands in the Mainland Region were assigned drained ratings by BCLI these figures probably underestimate the magnitude of drainage constraints in the region.

The 1978 SSCA report indicates that the ALR lands of the Mainland Region contain approximately 11,500 of wetlands requiring drainage.

A study carried out by Talisman for ARDSA in 1979 reinforces the belief that the above estimates are too low. The Status Report on the Fraser River Flood Control Program (FRFCP) indicates that approximately 50,000 ha of Fraser Valley floodplain within the ALR was classified by BCLI as having wetness (internal drainage) limitations (Talisman, 1979). In addition, this study tabulated approximately 5000 ha of floodplain ALR lands with indundation (flooding) limitations. For the most part, these latter areas are situated outside of the existing Fraser Valley dykes. All of the estimates contained in the FRFCP status report were derived from original SSCA mapping of Mainland Region ALR lands.

BCLI mapping of Mainland Region agricultural lands did not assign improved ratings for irrigated cultivation. However, much of the area does incur periodic climatic moisture deficits and would benefit from irrigation. Although most Lower Fraser Valley cultivation was initially developed on a rainfed basis, considerable supplemental irrigation has been developed in recent years. While it is not possible to estimate the extent of Mainland Region agricultural soils constrained by growing season water deficits from the available tabulated land inventory data, it has been assumed that this area comprises at least 50,000 ha.

Okanagan Region

The 1976 ARDA report indicates that approximately 76,000 ha of

Okanagan Region lands classified by the original BCLI program as unimproved Class 5 would improve one or more capability classes if irigation and/or drainage was provided, and for most of these lands it is expected that irrigation represents the only water management improvement required. In addition, about 3000 ha of lands rated as unimproved Class 6 or 7 would improve if drainage was provided. These estimates do not address potential irrigation and drainage improvements within an additional 132,000 ha of lands rated unimproved Class 2-4, of which no more than 103,000 ha have been classified as improving with irrigation and/or drainage. In total, the available tabulated land inventory statistics indicate that 79,000-182,000 ha of Okanagan Region agricultural lands have improvement potential related to irrigation and drainage, with irrigation being the improvement required for almost all of these lands.

The 1978 SSCA report indicates that the ALR lands of the Okanagan Region contain approximately 2,000 ha of wetlands requiring drainage.

Kootenay Region

The 1976 ARDA report indicates that approximately 98,000 ha of Kootenay Region lands classified by the original BCLI program as unimproved Class 5 would improve one or more capability classes if irrigation and/or drainage was provided. For most of these lands it is expected that irrigation represents the only water management improvement required. In addition, about 1000 ha of lands rated as unimproved Class 6 or 7 would improve if drainage was provided. These estimates do not address potential irrigation and drainage improvements within an additional

185,000 ha of lands rated unimproved Class 2-4. At most, it is estimated that 101,000 ha of these lands have been classified as improving with irrigation and/or drainage. In total, the available tabulated land inventory statistics indicate that 99,000-200,000 ha of Kootenay Region agricultural lands have improvement potential related to irrigation and drainage, again with irrigation likely to be the only improvement required for the majority of these lands.

The 1978 SSCA report indicates that the ALR lands of the Kootenay Region contain less than 1,000 ha of wetlands requiring drainage. Additional mineral soil areas, particularly on the Columbia and Kootenay River floodplains, also require drainage.

Thompson Region

The 1976 ARDA report indicates that approximately 206,500 ha of Thompson Region lands classified by the original BCLI program as unimproved Class 5 would improve one or more capability classes if irrigation and/or drainage was provided, With irrigation representing the only water management improvement required for almost all of these lands. In addition, at least 3500 ha of lands rated as unimproved Class 6 or 7 would improve if drainage was provided. These estimates do not address potential irrigation and drainage improvements within an additional 113,000 ha of lands rated unimproved Class 2-4, most of which would benefit from irrigation. In total, the available tabulated land inventory statistics indicate that 210,000-323,000 ha of Thompson Region agricultural lands have improvement potential related to irrigation and/or drainage.

However, for almost all of these lands, irrigation is likely to be the only improvement required.

The 1978 SSCA report indicates that the ALR lands of the Thompson Region contain approximately 3,000 of wetlands requiring drainage.

Cariboo Region

The 1976 ARDA report indicates that approximately 351,000 ha of Cariboo Region lands classified by the original BCLI program as unimproved Class 5 would improve one or more capability classes if irigation and/or drainage was provided. For most of these lands it is expected that irrigation represents the only water management improvement required. In addition, about 42,000 ha of lands rated as unimproved Class 6 or 7 would improve if drainage was provided. These estimates do not address potential irrigation and drainage improvements within an additional 385,000 ha of lands rated unimproved Class 2-4. At most, it is estimated that 296,000 ha of these lands have been classified as improving with irrigation or drainage. In total, the available tabulated land inventory statistics indicate that 393,000-689,000 ha of Cariboo Region agricultural lands have improvement potential related to irrigation and drainage. It is expected however, that irrigation represents the only improvement required for the majority of these lands, although extensive areas of wetlands requiring drainage are included in these totals.

The 1978 SSCA report indicates that the ALR lands of the Cariboo Region contain 40,000 of wetlands requiring drainage. The 1976 ARDA report indicates that all wetland areas in the

Cariboo, including considerable lands outside of the ALR, total approximately 10% of lands classified by the BCLI program, which would amount to over 400,000 ha. However, many of these areas are located at too high an elevation to have any capability for agricultural development.

It has been suggested that the original BCLI agricultural capability classification in the Cariboo Region overrated extensive areas, particularly in the higher elevations of the Cariboo Plateau west of the Fraser River. Although little new inventory work has been carried out in these areas, a major conclusion of both the SSCA inventory compilation in this region (SSCA, 1978), as well as a study of this area for the B.C. Ministry of Lands, Parks and Housing (Talisman, 1984), is that the overall agricultural capability of the Cariboo Plateau is less than indicated by the original BCLI mapping. In addition, new climate mapping in parts of the Cariboo Plateau points to lower climate capability for agriculture than originally indicated. In light of these conclusions, it is possible that the above figures overstate the magnitude of water constraints within the region.

Omineca Region

For the purposes of this report, the Omineca Region is assumed to consist of the Omineca and Skeena regions defined in the 1976 ARDA report. The ARDA report indicates that approximately 14,000 ha of Omineca lands (Fraser River drainage) classified by the original BCLI program as unimproved Class 7 would improve to Class 5 or better if drainage was provided. In addition, up to another 13,000 ha of unimproved Class 5 and 6 lands may improve with drainage. In total, the tabulated land

inventory statistics suggest that between 14,000-27,000 ha of Omineca lands have improvement potential related to drainage. The 1978 SSCA report indicates that the ALR lands of this area contain approximately 13,000 of wetlands requiring drainage.

In the portion of the Omineca Region within the Skeena drainage, the ARDA report indicates that from 24,000-33,000 ha of Class 4 and 5 lands would improve with drainage. The 1978 SSCA report indicates that this area contains approximately 3,500 ha of wetlands.

The original BCLI program did not assign irrigated ratings to agricultural lands mapped within the Omineca Region. Although rainfed production of many crops is possible, portions of the region, notably the Nechako and Bulkley valleys, incur a climatic moisture deficit during the growing season and crops grown in these areas benefit from irrigation. A study carried out by Talisman for Envirocon Limited and Alcan provides some insight into the extent of regional agricultural lands that would benefit from irrigation. The report Potential Irrigation Demand in the Nechako and Bulkley River Valleys indicates that approximately 54,000 ha in the Nechako valley and an additional 39,000 ha in the Bulkley valley are irrigable (Talisman, 1982). While some other water deficit areas exist in the region (eg. the Valemount area), for the most part these areas contain relatively minor extents of irrigable lands.

In total, in the Omineca Region, the above land inventory information suggests that from 38,000-60,000 ha of regional lands would benefit from drainage improvements and about 93,000 ha would benefit from irrigation.

REGIONAL OVERVIEW OF WATER CONSTRAINTS

Peace Region

The ARDA report indicates that approximately 358,000 ha of Peace Region lands classified by the original BCLI program as unimproved Class 6 or 7 would improve one or more capability classes if drainage was provided. In addition, up to another 54,000 ha of unimproved Class 4 and 5 may improve with drainage. In total, the tabulated land inventory statistics suggest that between 358,000-412,000 ha of Peace Region lands have improvement potential related to drainage. The 1978 SSCA report indicates that the ALR lands of this area contain approximately 102,000 ha of wetlands requiring drainage.

Much of the area classified in the Peace Region as improving with drainage is comprised of areas of peat soils. Recent studies of extensive areas of such lands carried out by Talisman for the B.C. Ministry of Lands, Parks and Housing suggest that many of these areas were overrated in the original BCLI inventory and have no suitability for cultivated agriculture (Talisman, 1983, 3 reports). In light of these findings, it is possible that the above figures overestimate the potential for drainage development in the region.

Provincial Summary

Table 4.1 summarizes the findings of the regional overview of water constraints related to drainage and irrigation. If the BCLI figures showing the major drainage improvement potential of the Peace Region are accepted, the estimate of all agricultural lands in the province constrained by poor drainage is 501,000-577,000+. It is estimated that less than 50,000 ha of this area has drainage works in place.

Table 4.1

WATER CONSTRAINTS TO AGRICULTURE
BY AGRICULTURAL REGION
(hectares)

AGRICULTURAL REGION	LANDS WITH CONSTRAINTS RELATED TO DRAINAGE	LANDS WITH CONSTRAINTS RELATED TO IRRIGATION
Island	4,500+	79,000 to 166,000
Mainland	50,000	50,000+
Okanagan	3,000+	79,000 to 182,000
Kootenay	1,000+	99,000 to 200,000
Thompson	3,500+	210,000 to 323,000
Cariboo	42,000+	393,000 to 689,000
Omineca	38,000 to 60,000	93,000
Peace	358,000 to 412,000	nil
TOTAL, B.C.	501,000 to 577,000+	1,003,000 to 1,703,000

REGIONAL OVERVIEW OF WATER CONSTRAINTS

All agricultural lands in the province that are constrained by water deficits during the growing season are estimated to total 1,003,000-1,703,000 ha. This figure includes all Cariboo Region lands classified by the BCLI as having improvement potential. Existing irrigation works service an estimated 100,000 ha of this area.

As indicated at the beginning of this chapter, inclusion of lands within these totals does not indicate that it is technically possible or economically feasible for the water constraints documented to be relieved. Most of these lands do not have ready access to sources of irrigation water and many of the poorly drained lands do not have suitable drainage outlets. In much of the remaining lands, the benefits of relieving the indicated water constraints fall far short of the required improvement costs and will continue to do so for the foreseeable future, barring any unexpected radical improvement in the terms of trade for agricultural products.

For the remaining lands within this inventory of water constraints, however, feasible water management opportunities may exist at present or in the near future. The next chapter attempts to provide an initial indication of the extent of such opportunities.

5

WATER MANAGEMENT OPPORTUNITIES

REGIONAL WORKSHOPS

Contacts with Regional Agencies and Authorities

A program of eight regional workshops were held throughout the province to help define specific water management opportunities. These workshops were attended by various federal and provincial agency staff knowledgeable of each region's land and water resources.

As this program of workshops was set up on fairly short notice and was held during a time when a number of people who could have provided valuable input to the workshop had made previous commitments or were on vacation, some areas were not covered in as much detail as would otherwise have been possible. To partially overcome this situation, a number of people were contacted subsequent to the workshops to obtain their input regarding specific projects or other aspects of the regional overview of water constraints.

In addition, a letter was sent from Mr. M.G. Oswell, Acting Assistant Deputy Minister, BCMAF, to all water management authorities (irrigation districts, dyking districts, etc.) in

the province asking for input into both the literature compilation phase and identification of water management opportunities phase of the project. Although none of these authorities provided completed report information sheets, one did provide lists of pertinent reports and a number provided information on specific water management opportunities within their jurisdictions.

The following sections provides locations, dates and a list of participants for each of the regional workshops, along with any additional contacts made in reference to each region and a list of the various water management authorities which provided information for each region.

Mainland Region

workshop date and location:

August 13, 1984 at BCMAF District Office, Abbotsford

participants:

Roger Bryant	BCMAF - Engineering	Abbotsford
Ron Charles	BCMAF - Extension Services	Abbotsford
Bob Edwards	BCME - Water Management	Surrey
John Keng	Agriculture Canada - Soils	Agassiz
John Metzger	BCMAF - Engineering	Abbotsford
Harvey Sasaki	BCMAF - Farmland Resources	Victoria
Mark Sweeney	BMCAF - Horticulture	Abbotsford
Ted Vander Gulik	BCMAF - Engineering	Abbotsford
Wayne Wickens	BCMAF - Regional Director	Abbotsford

additional contacts:

Ken Wilson	BCME - Water Management Branch	Victoria
Martin Driehuyzen	BCMAF - Soils	Cloverdale
Terry Dever	BCMAF - Extension Services	Chilliwack
Gary Wickham	District of Chilliwack - Engineering	Chilliwack

input from water management authorities:

The District of Surrey, R. Chaboyer, P.Eng.
Pemberton Valley Dyking District, Mrs. D.R. Proudlock

Island Region

workshop date and location:

July 30, 1984 at Water Management Branch offices, Victoria

participants:

Bruno Blecic	BCME - Water Management	Nanaimo
Martin Driehuyzen	BCMAF - Soils	Cloverdale
Jack Eby	BCME - Water Management	Victoria
John Metzger	BCMAF - Engineering	Abbotsford
Harvey Sasaki	BCMAF - Farmland Resources	Victoria
Erich Schulz	BCMAF - Engineering	Victoria
Wayne Ulrich	Agriculture Canada	Victoria

WATER MANAGEMENT OPPORTUNITIES

Peter Wallin	BCMAF - ARDA	Victoria
Wayne Wickens	BCMAF - Regional Director	Abbotsford

Okanagan Region

workshop date and location:

August 7, 1984 at BCME offices, Penticton

participants:

Jack Botham	BCME - Water Management	Penticton
Craig Brownlee	BCMAF - Soils	Kelowna
John Hansen	Agriculture Canada	New Westminster
Herb Luttmerding	BCME - Survey & Mapping	Kelowna
John Parsons	BCMAF - Horticulture	Oliver
Harvey Sasaki	BCMAF - Farmland Resources	Victoria
Ken Soneff	BCME - Water Management	Penticton
Dave Stevenson	Agriculture Canada - Soils	Summerland
Ted Vander Gulik	BCMAF - Engineering	Abbotsford
Peter Wallin	BCMAF - ARDSA	Victoria

additional contacts:

Bob France	BCMAF - Extension Services	Vernon
	Westbank Irrigation District	
Ed Beale	Keremeos Irrigation District	

WATER MANAGEMENT OPPORTUNITIES

input from water management authorities:

Glenmore Irrigation District, Len Tonn
Vernon Irrigation District, B.S. Harvey
Cawston Irrigation District, A.S. Wainwright
Oyama Irrigation District, L. Giroux
Wood Lake Improvement District, L. Giroux
Kaleden Irrigation District, Mrs. G. Gane
Southern Okanagan Lands Irrigation District, W.S. Ross Sr.
South East Kelowna Irrigation District, S.B. Mould, P.Eng.
Ellison Irrigation District, R.B. Scott, C.A.
Black Mountain Irrigation District
Boundary Line Irrigation District, Mrs. G.E. Van Nes

Kootenay Region

workshop date and location:

August 8, 1984 at BCMAF offices, Cranbrook

participants:

Craig Brownlee	BCMAF - Soils	Kelowna
Brian Laing	BCMAF - Extension Services	Creston
Mike Malmberg	BCMAF - Extension Services	Cranbrook
Harvey Sasaki	BCMAF - Farmland Resources	Victoria
Ivan Velisek	BCME - Water Management	Nelson

WATER MANAGEMENT OPPORTUNITIES

input from water management authorities:

Slocan Park Improvement District, Sam P. Verigin
Blueberry Creek Irrigation District, Wm. Kavaloff
Balfour Irrigation District, M.M. Stainton
Ootischenia Improvement District, A. Sheppard

Thompson Region

workshop date and location:

August 9, 1984 at BCMAF offices, Kamloops

participants:

Lance Brown	BCMAF - Engineering	Kamloops
Craig Brownlee	BCMAF - Soils	Kelowna
Al Isfeld	BCMAF - Regional Director	Kamloops
Herb Luttmerding	BCME - Survey & Mapping	Kelowna
Al Oliver	BCMAF - Horticulture	Kamloops
Ron Reid	BCME - Water Management	Kamloops
Harvey Sasaki	BCMAF - Farmland Resources	Victoria
Graham Strachan	BCMAF - Extension Services	Kamloops
Al van Ryswyk	Agriculture Canada - Soils	Kamloops

additional contacts:

Stan Duggan	BCME - Water Management	Kamloops
Ted Berry	BCMAF - Extension Services	Salmon Arm

WATER MANAGEMENT OPPORTUNITIES

input from water management authorities:

Chase Irrigation District, Don Cavers

Cariboo Region

workshop date and location:

August 2, 1984 at BCMAF offices, Williams Lake

participants:

Peter Fofonoff	BCMAF - Extension Services	Williams Lake
Harvey Sasaki	BCMAF - Farmland Resources	Victoria

Omineca Region

workshop date and location:

August 1, 1984 at BCMAF offices, Prince George

participants:

Garth Elgie	BCMAF - Extension Services	Prince George
Uwe Finger	BCME - Water Management	Prince George
Rob Kline	BCMAF - Soils	Prince George
Bob Kohlert	BCMAF - Regional Director	Prince George
Bill Pringle	Agriculture Canada	Prince George

WATER MANAGEMENT OPPORTUNITIES

Harvey Sasaki	BCMAF - Farmland Resources	Victoria
Al Watkins	BCMAF - Extension Services	Quesnel

Peace Region

workshop date and location:

August 16, 1984 at BCMAF offices, Dawson Creek

participants:

Larry Bomford	BCMAF - Extension Services	Ft. St. John
Brian Harper	BCMAF - Extension Services	Dawson Creek
Kathy Sandy	BCMAF - Extension Services	Dawson Creek
Harvey Sasaki	BCMAF - Farmland Resources	Victoria

Comprehensiveness of Regional Inventories

With the input from the workshops, from the various water management authorities, and from the subsequent contacts it is felt that a reasonably good general overview of water constraints and water management opportunities was obtained. However, time and budgetary constraints limited the discussion of many opportunities to a general identification only and an extremely rough estimate of the potentially benefiting area. In some cases, additional information on specific opportunities could have been provided with relatively little additional work (such as review of additional reports or additional contacts with persons knowledgeable with the area). In other instances, the specific water management opportunity identified has never

been studied and the only available information is that a constraint exists which if overcome would result in increased agricultural production. For many cases, information on the productive potential with and without water constraints was often only very general, and no information on the costs of alleviating the water constraints was available.

It is stressed that all data on water management opportunities generated in this study are preliminary and are largely unsupported by detailed, project-specific technical studies. The probability and degree of error in the presented data is likely to be high. Additionally, due to the unavailability of key personnel at the Regional workshops, or the lack of response from key water management authorities, the data generated may not have fully identified the total extent of water management opportunities. As well, the data are limited by professional judgements made with respect to economic reasonableness. In particular, this latter limitation applies to possible streambank erosion and flood control opportunities, where the concensus reached at the regional workshops was that most such potential projects were far too costly to be included in an inventory of water management opportunities.

All water management opportunities identified in the workshop and associated consultative procedure were recorded on standardized description sheets (see Appendix C) and sorted by agricultural district. Copies of all recorded sheets are contained in the second half of the compendium which accompanies this report.

The following sections provide regional synopses which discuss the general nature of projects, costs and types of benefits, and summaries of the identified water management opportunities.

WATER MANAGEMENT OPPORTUNITIES

REGIONAL SYNOPSES

It should be noted that the figures for off-farm and on-farm drainage and irrigation opportunities do not necessarily correspond to one another. In some cases existing on-farm works may already be in place that would benefit from regional improvements. In other cases, on-farm opportunities have been identified which do not require off-farm works. In other cases, errors in estimating the areal extents of benefitting areas may be responsible for observed divergences between estimated on-farm and off-farm opportunities.

Mainland Region

The majority of the water management opportunities outlined for the Mainland Region are primarily concerned with drainage improvements, with irrigation water supply improvements associated with the drainage works in some cases. The opportunity which is considered to have the highest priority is the proposed East Delta project (see Volume 2, Ref. No. 1-6), which involves both regional drainage works and improved irrigation water supplies via a diversion from the Fraser River.

Other areas for which major regional drainage improvements are needed are the Matsqui Prairie (Ref. No. 2-3) and the Nicomekl-Serpentine floodplain (Ref. Nos. 1-9 to 1-17) areas. Within the Nicomekl-Serpentine area the sub-area with the highest priority is considered to be the Erickson Ditch area (Ref. No. 1-15). A project in this area would be similar to the

recently completed Old Logging Ditch (Ref. No. A-4) and Burrows Ditch (Ref. No. A-5) projects and would involve improved irrigation water supplies as well as drainage works. Current thinking with respect to the Matsqui Prairie area is that improvements should be considered on a sub-area basis, as previous plans to provide drainage improvements to the entire area have not appeared to be economically viable.

A recurring problem with established drainage projects which was highlighted during the workshop session was that of ditch maintenance once a project was in place. The responsibility for maintenance usually resides with a municipality or other local authority and it appears that too often the municipality or local authority feels that funds are not available to provide an adequate maintenance program.

With respect to potential regional irrigation development, the two most important opportunities appear to involve water supplies for cranberry operations in the Richmond and Delta areas (Ref. No. 1-3), and irrigation water supplies for the upland areas around Langley and Aldergrove (Ref. No. 2-9). Cranberry operations have high water requirements in the spring (for frost protection) and in the fall (for harvest). While water requirements are generally not limiting in the spring, fall supplies often are and have limited expansion in some instances. The Langley-Aldergrove upland areas generally have water deficits during the growing season, but as this deficit is not usually severe, high-cost supply schemes cannot be justified. At present, groundwater appears to be the only feasible source for any expansion of irrigation, and then only for those areas where groundwater can be developed at a reasonable cost. While considerable such groundwater development would take place on a small, on-farm scale, some

opportunities for regional schems are thought to exist in this area.

Tables 5.1 to 5.3 list the other drainage opportunities which were identified during this study for the Lower Fraser Valley area. These tables list opportunities in the Cloverdale, Abbotsford, and Chilliwack District Office areas, respectively. Collectively, total potential works identified in this region are estimated to cost between $71-150 million, and comprise the largest regional assembly of potential water management opportunities in the province.

Island Region

The water management opportunities identified for the Vancouver Island area include both drainage and irrigation, with the majority of the opportunities being of a relatively small scale. The most notable exception to this is a project to supply irrigation water to the Saanich Peninsula (Ref. No. 4-3). Although an economic evaluation has not been carried out for this ambitious project, it is likely that costs will be very high an may prove to be prohibitive.

Tables 5.4 and 5.5 summarize the opportunities which were identified for the Vancouver Island area. These tables summarize potential works in the Duncan and Courtenay District Office areas, respectively, and total $30-52 million.

Table 5.1

WATER MANAGEMENT OPPORTUNITIES

CLOVERDALE AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES GROUNDWATER STORAGE	SURFACE	ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
Richmond-Hwy 99		300				
East Richmond		2000		2000	1000	
Richmond	1460					
Delta-Burns Bog				200	200	
Harbours Board	800					
Big Bend	50					
East Delta		2300		2300	1000	
Delta	2050					
Campbell River		50				50
Minnekhada Farm	120	250				
Pemberton Valley						1800
Nicomekl-Serpentine	1890					
Serpentine Canal		300		300	300	300
Hwy 10 North		85		85	85	85
48th Ave. North		140		140	140	
152nd St. East		250		250	250	
160th St. East		195		195	195	
168th St. East		255		255	255	
Erickson Ditch		475		475	475	
Colebrook		800				
83rd Ave. North		175		175	175	175
Total (ha)	6370	7625		6375	4075	2410
cost x $1000	7644	6116 to 16041		617 to 1013	2445 to 13040	3740 to 4287

Regional Works: $10,473,000 - $21,341,000

On-Farm Works: $10,089,000 - $20,684,000

Table 5.2

WATER MANAGEMENT OPPORTUNITIES

ABBOTSFORD AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Sumas Prairie	2600	7600			500	
Matsqui Prairie	540	7300				
Hatzic Lake	390	1165				
Silverdale	120	400				400
Pitt Polder	770	1500				1500
Alouette River	360	900				900
East Langley	170	250				250
Langley Uplands	1000		1000		1000	
Bertrand Creek						50
Salmon River	150	450				500
West Langley	240	310				310
Pitt Meadows	830				500	
Nicomen Island	290					
Glen Valley	180					
Total (ha)	7640	19875	1000		2000	3910
cost x $1000	9168	15940 to 52987	3196 to 3824		1200 to 6400	6088 to 6956

Regional Works: $25,204,000 - $63,767,000

On-Farm Works: $10,368,000 - $15,568,000

Table 5.3

WATER MANAGEMENT OPPORTUNITIES

CHILLIWACK AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Salwein Creek		235				
Columbia Valley			1535		1535	
Carey Point						70
Hammersly Plain		130				
Young Road						200
Durnville Creek		415				
Everett Ditch		135				
Hope River		6000				
Gibson Road		200				
Seabird Island				400	400	
Chawuthen I. R.	300	300				
Grigg Road		20				
Chilliwack	2190				200	
Kent	870				200	
Total	3360	7435	1935		2335	270
cost x $1000	4032	3729 to 4530	4259 to 11033		1401 to 7472	1810 to 1856

Regional Works: $9,798,000 - $17,419,000

On-Farm Works: $5,433,000 - $11,504,000

Table 5.4

WATER MANAGEMENT OPPORTUNITIES

DUNCAN AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES GROUNDWATER STORAGE	SURFACE	ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
Central Saanich	1200					
Cobble Hill-Malahat	400					
Whitehouse Creek		200				
Bings Creek			150*	150*	150	
Quamichan Lake		120				
Cowichan Indian Reserve	800				800	
Kelvin Creek		100				100
Dougan Lake	100	200				
Saanich Peninsula			1700*		1700	
North Saanich	400					
Wallace Drive		100				
Martindale Valley	300	300				
Colquitz	200	200				
Blenkensop	100	100				
Total (ha)	3500	1320	1850		2650	100
cost x $1000	4200	1132 to 2809	12561 to 12926		1590 to 8480	155 to 178

Regional Works: $13,848,000 - $15,913,000

On-Farm Works: $5,790,000 - $12,680,000

* potential water supply not defined or from a combination of sources

Table 5.5

WATER MANAGEMENT OPPORTUNITIES

COURTENAY AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Stamp River	200			300	300	
French Creek				170	170	
Comox			500		500	
Headquarters Rd.			2000		2000	
Black Creek		100	600		600	
Total (ha)	200	100	3570		3570	
cost x $1000	240	80 to 2666	7655 to 8563		2142 to 11424	

Regional Works: $7,735,000 - $11,229,000

On-Farm Works: $2,382,000 - $11,664,000

WATER MANAGEMENT OPPORTUNITIES

Okanagan Region

As would be expected, the major water management opportunities identified for the Okanagan area involve irrigation improvements. In most areas, however, readily available water supplies and/or suitable storage sites have been fully developed and further expansion of irrigation will be limited to schemes pumping form mainstem watercourses. Such developments are expected to involve relatively high unit costs.

A major irrigation opportunity identified is that of water supplies for the Spallumcheen area (Ref. No. 7-2). Costs for this project have been estimated (Ref. No. B-2) and even though unit supply costs are relatively low, it appears that there may not be a sufficient degree of acceptance by area producers for this large project to be implemented.

One aspect of irrigation within the Okanagan which was discussed at some length during the workshop session pertained to the efficiency of use of the available developed water supplies. In many instances, rehabilitation of older irrigation systems has already reduced losses and made more water available for irrigation. However, it appears that the irrigation scheduling habits of many of the producers offer opportunities for improved efficiencies. In general, tree fruit growers are not willing to accept any risk in their scheduling of irrigations and the result is that over-irrigation often occurs. Although this zero-risk approach by existing growers may prove to be valid, the situation appears to warrant further attention.

Identified water management opportunities for the Okanagan area

are summarized in Tables 5.6 to 5.8. These tables summarize inventory findings for the Salmon Arm, Vernon, and Oliver District Office areas respectively, and identify potential works totalling $54-99 million in estimated capital costs.

Kootenay Region

As with the Okanagan, the majority of the water management opportunities identified for the Kootenay Region involve irrigation. A number of these, such as in the Lister (Ref. No. 9-3) and Grasmere (Ref. No. 10-1) areas, would entail large projects if implemented.

The most significant drainage opportunity involves the lowlands near Creston (Ref. No. 9-1). This opportunity is felt to involve primarily on-farm works, however some regional drainage works might also be required.

One concern expressed during the workshop session for this region suggested that irrigation systems, either proposed or already constructed, tend to be overdesigned both in terms of supply requirements and in the works themselves. In many cases, the cropping patterns within the benefiting areas indicated that a greater degree of risk in the reliability of water supplies could be accepted.

Kootenay area water management opportunities are summarized in Tables 5.9 and 5.10. These tables, summarizing opportunites in

Table 5.6

WATER MANAGEMENT OPPORTUNITIES

SALMON ARM AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Malakwa	200	200				
Tappen/Notch Hill				2000	2000	
Total (ha)	200	200		2000	2000	
cost x $1000	240	160 to 533		6170 to 10134	1200 to 6400	

Regional Works: $6,330,000 - $10,667,000

On-Farm Works: $1,440,000 - $6,640,000

Table 5.7

WATER MANAGEMENT OPPORTUNITIES

VERNON AGRICULTURAL DISTRICT
(in hectares of benefitting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Deep Creek	200	200				
Spallumcheen			5000*	5000*	5000	
Wood Lake Imp. Dist.	rehabilitation +		51			
Oyama Irr. Dist.	rehabilitation +		15			
Westbank Irr. Dist.				100	100	
Westbank I.R.				100	100	
Ellison Irr. Dist.	rehabilitation +			18	18	
Glenmore Irr. Dist.			196			
SEKID			570			
Inonoaklin Creek				1600	1600	
Black Mtn. Irr. Dist.			530		530	
Total (ha)	200	200	8180		7348	
cost x $1000	240	160 to 533	34541 to 40410		4409 to 23514	

Regional Works: $34,701,000 - $40,934,000

On-Farm Works: $4,649,000 - $23,754,000

* potential water supply not defined or from a combination of sources

Table 5.8

WATER MANAGEMENT OPPORTUNITIES

OLIVER AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Naramata Irr. Dist.			rehabilitation			
Summerland Irr. Dist.			100*		100	
Penticton I.R.			452*	452*	452	
West OK Falls				200	200	
Kaleden Irr. Dist.			alternate supply			
Similkameen Valley	400				400	
SOLID			rehabilitation			
Oliver Lowlands	300	300				
Inkaneep I.R.					400	
Kettle R/Granby R.					2000	
Total (ha)	700	300	752		3552	
Cost x $1000	840	241 to 800	3769 to 4408		2131 to 11366	

Regional Works: $4,010,000 - $5,208,000

On-Farm Works: $2,971,000 - $12,206,000

* potential water supply not defined or from a combination of sources

Table 5.9

WATER MANAGEMENT OPPORTUNITIES

CRESTON AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Creston	800					
Corn Creek			80		80	
Lister				2500	2500	
Kitchener Creek	150					
Columbia Gardens					70	
Pend Oreille River				100	100	
Champion Creek					120	
Cotischenia			370*	370*	370	
Lemon Creek						100
Meadow Creek	200					
Slocan Park		30			200	
East Creston Irr. Dist.				400	400	
Total (ha)	1150	30	3450		3840	100
cost x $1000	1380	24 to 80	10484 to 17623		2304 to 12288	155 to 178

Regional Works: $10,663,000 - $17,881,000

On-Farm Works: $3,684,000 - $13,668,000

* potential water supply not defined or from a combination of sources

Table 5.10

WATER MANAGEMENT OPPORTUNITIES

CRANBROOK AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT						
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES			ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER	STORAGE	SURFACE		
Grasmere			1500*		1500*	1500	
Elk River			400*		400*	400	
Newgate				200			
Kootenay R.					2500	2500	
Kootenay R. lowlands	4500						
Rampart/Mayook					350	350	
St. Mary's Prairie					1500	1500	
Findlay Creek					200	200	
Fairmont Hot Springs					50	50	
Windermere I.R.						200	
Total (ha)	4500			6700		6700	
cost x $1000	5400			20037 to 34511		4020 to 21440	

Regional Works: $20,037,000 - $34,511,000

On-Farm Works: $9,420,000 - $26,840,000

* potential water supply not defined or from a combination of sources

the Creston and Cranbrook District Office areas, respectively, outline potential works in the Kootenay Region totalling $44-93 million in capital costs.

Thompson Region

Almost all of the water management opportunities identified for the Thompson Region involve irrigation. As was the case in the Okanagan, most of the readily available sources of water and the more attractive storage sites have already been developed and additional irrigation development is generally limited to pumping from mainstem sources.

The opportunity considered to have the highest priority within this region is the proposed Nicola Lake Dam project (Ref. No. 11-2) which would provide significant additional irrigation water supplies at a relatively low cost, and generate benefits to the fisheries resource at the same time.

Additional opportunities which appear to warrant a high priority in the Thompson Region involve the rehabilitation of existing, small-scale storage works (Ref. No. 11-1). Inspection of these works conducted by the Water Management Branch BCME indicate that a number of these storage structures are in need of work, and a significant number are in need of either major rehabilitation or replacement. In general, work of this nature would not increase the amount of irrigated land but rather would maintain supplies to existing operations. However, where storage works require replacement or a major amount of rehabilitation, the potential for additional storage should be investigated and incorporated into the project where possible.

WATER MANAGEMENT OPPORTUNITIES

Table 5.11, for the Kamloops District Office area, summarizes the identified Thompson area water management opportunities identified in this study. The total estimated capital cost of all works identified in this region is $24-64 million.

Cariboo Region

Regional water management opportunities identified in the Cariboo are mainly irrigation projects, however significant on-farm drainage opportunities were also identified, in particular those related to wetland development.

For those parts of the region where growing season water deficits are significant, the situation appears to be similar to the other water short regions of the province, with the readily available water supplies and more attractive storage sites already developed and with additional supplies generally limited to the main-stem rivers. For this region the two most significant opportunities of this nature are pumping from the Fraser (Ref. No. 12-12) and Chilcotin (Ref. No. 12-11) Rivers to adjacent benchlands.

In this region, it is possible that wetland development (Ref. No. 12-1) represents the least costly means of increasing forage production. However, for such development to proceed, wildlife interests and the interests of downstream users will have to be accommodated. The majority of any wetland development projects are expected to be of an on-farm scale.

Water management opportunities identified for the Cariboo Region, corresponding to the Williams Lake District Office area, are summarized in Table 5.12. Potential water management

Table 5.11

WATER MANAGEMENT OPPORTUNITIES

KAMLOOPS AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT						
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES			ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER	STORAGE	SURFACE		
Dam Rehabilitation				2500			
Nicola Lake				3300		3300	
Mamit Lake				200		200	
South Thompson					2600	2600	
Niskonlith Lake				500		500	
Thompson River					2200	2200	
Venables Valley				350		350	
Deadman Creek						600	
Douglas Lake Ranch						1000	
Bonaparte/Semlin			300*	300*		300	
Salmon River	400						
Monte Creek	100						
North Thompson						2000	
Chase I.D.					n/a		
Total (ha)	500			11950		13050	
cost x $1000	600			15671 to 20250		7830 to 41760	

Regional Works: $15,671,000 - $20,250,000

On-Farm Works: $8,430,000 - $42,360,000

* potential water supply not defined or from a combination of sources

Table 5.12

WATER MANAGEMENT OPPORTUNITIES

WILLIAMS LAKE AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Wetland Development	2000					
Beaver Creek	400					
Moffat Creek						100
Black Creek		200				
Little Bridge Creek				100	100	
Canim Lake	100					
Springhouse			200		200	
San Jose River	600					
Chimney Creek	50			300	300	
Hawks Creek				100	100	
Chilcotin River				1200	1200	
Fraser River				1200	1200	
Total (ha)	3150	200		3100	3100	100
cost x $1000	1880 to 2180	160 to 533		9144 to 15860	1860 to 9920	155 to 178

Regional Works: $9,459,000 - $16,571,000

On-Farm Works: $3,740,000 - $12,100,000

works identified for this region comprise an estimated $13-29 million in total capital costs.

Omineca Region

No major regional water management opportunities were identified in the Central Interior area except for some flood and streambank protection for lowlands adjacent to the Chilako River (Ref. No. 14-2), and for irrigation supply projects on the Fraser River benchlands south of Quesnel (Ref. No. 13-1; included in the summary for the Williams Lake District).

On-farm irrigation opportunities were identified for some areas, however, it is expected that development will be on a small scale and will not be widespread in any area. It was felt that even for those areas where irrigation is currently practised the economic feasibility is, in general, marginal.

A general water related problem which was identified during the Omineca workshop session (Prince George) was that of poor infiltration capacities and resultant drainage problems. This situation is quite prevalent in the lacustrine deposits within the Prince George and Vanderhoof Districts Office areas. The immediate requirement is more of a research opportunity than a regional development opportunity in that more information is required before suitable recommendations for alleviating the problem can be made.

The water management opportunities which were identified for the Omineca Region are summarized in Tables 5.13 to 5.16 for the Quesnel, Prince George, Vanderhoof, and Smithers District Office areas, respectively. Works identified in the Quesnel

Table 5.13

WATER MANAGEMENT OPPORTUNITIES

QUESNEL AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT						
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES			ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER	STORAGE	SURFACE		
Fraser River Benchlands	(see Williams Lake District Summary)						
Wetland Development	(see Williams Lake District Summary)						

Table 5.14

WATER MANAGEMENT OPPORTUNITIES

PRINCE GEORGE AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT						
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES			ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER	STORAGE	SURFACE		
low infiltration capacity soils/drainage problems							
Chilako R. Valley						200	200
Valemont						300	
Total (ha)						500	200
cost x $1000						300 to 1600	310 to 356

Regional Works: $310,000 - $356,000

On-Farm Works: $300,000 - $1,600,000

Table 5.15

WATER MANAGEMENT OPPORTUNITIES

VANDERHOOF AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Nechako R. Valley					500	
Total (ha)					500	
cost x $1000					300 to 1600	

On-Farm Works: $300,000 - $1,600,000

Table 5.16

WATER MANAGEMENT OPPORTUNITIES

SMITHERS AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Bulkley R. Valley					500	
Total (ha)					500	
cost x $1000					300 to 1600	

On-Farm Works: $300,000 - $1,600,000

District are associated with potential water management opportunities in the Cariboo Region and have been included in the inventory or opportunities presented for the Williams Lake District Office area (Table 5.12). Potential works identified in the remaining areas total $1-5 million in estimated capital costs.

Peace Region

The water management opportunities identified for the Peace Region are limited to drainage projects involving surface rather than subsurface drainage systems. Associated with these potential works are management opportunities to reduce water related soil erosion. While it was generally felt that assistance for such works should be available to individuals rather than be limited to groups, it was stressed that drainage and water control projects should be planned in a broader context to avoid displacing the problem to downstream landowners.

Except for the possibility of small, isolated cases, irrigation is not considered economically feasible in this area.

Water related constraints do not appear to be the most severe development type constraints to agriculture in the Peace Region. Workshop participants indicated that rather than providing assistance through water related projects, agricultural development programs would provide greater benefits if they increased assistance for land development and the purchase of specialized equipment. Another development opportunity which was identified in the regional workshop (Dawson Creek) is that of lime application on the region's acid

soils. At present, high transportation costs and the prolonged period during which the benefits of liming become apparent have limited adoption of this practice. As the economic feasibility of liming has not been fully investigated, it is felt that this area represents a significant research opportunity.

The specific water management opportunities identified in the Peace Region are summarized in Table 5.17. This table outlines inventory findings for the Dawson Creek District Office area. Although general water management opportunities were identified for the Fort St. John District Office area, particularly those related to soil conservation, no specific project opportunities were outlined. Total capital costs associated with potential works identified in this region are estimated at $300,000-1,600,000.

PROVINCIAL SUMMARY

Regional (Off-farm) Works

Approximate capital costs for the regional projects which were identified are summarized, by District Office area, in Table 5.18, with potentially benefiting areas summarized in Table 5.19.

The total of these capital cost estimates for all regional water management opportunities identified in the province is $171-281 million. This amount does not include on-farm drainage or on-farm irrigation which are discussed in the following sections.

Table 5.17

WATER MANAGEMENT OPPORTUNITIES

DAWSON CREEK AGRICULTURAL DISTRICT
(in hectares of benefiting areas)

ASSIGNED OPPORTUNITY NAME	WATER MANAGEMENT ELEMENT					
	ON-FARM DRAINAGE	REGIONAL DRAINAGE	IRRIGATION WATER SUPPLIES		ON-FARM IRRIGATION	FLOOD/BANK PROTECTION
			GROUNDWATER STORAGE	SURFACE		
Rolla & Saskatoon Creeks		1000				1000
East Rolla	2000					
Doe River	500	500				
Del Rio	400					
Total (ha)	2900	1500				1000
cost x $1000	3480	1203 to 3999				1552 to 1779

Regional Works: $2,755,000 - $5,778,000

On-Farm Works: $3,480,000

Table 5.18

REGIONAL WATER MANAGEMENT OPPORTUNITIES

ESTIMATED RANGE OF CAPITAL COSTS SUMMARY
(1984 $'s x 1000)

AGRICULTURAL DISTRICT	REGIONAL DRAINAGE	REGIONAL IRRIGATION	FLOOD & STREAMBANK PROTECTION	TOTAL
Cloverdale	6116-16041	617-1013	3740-4257	10473-21341
Abbotsford	15940-52987	3196-3824	6068-6956	25204-63767
Chilliwack	3729-4530	4259-11033	1810-1856	9798-17419
Duncan	1132-2809	12561-12926	155-178	13848-15913
Courtenay	80-2666	7655-8563	-	7735-11229
Salmon Arm	160-533	6170-10134	-	6330-10667
Vernon	160-533	34541-40410	-	34701-40943
Oliver	241-800	3769-4408	-	4010-5208
Creston	24-80	10484-17623	155-178	10663-17881
Cranbrook	-	20037-34511	-	20037-34511
Kamloops	-	15671-20250	-	15671-20250
Williams Lake	160-533	9144-15860	155-178	9459-16571
Quesnel *	-	-	-	-
Prince George	-	-	310-356	310-356
Vanderhoof	-	-	-	-
Smithers	-	-	-	-
Dawson Creek	1203-3999	-	1552-1779	2755-5778
Ft. St. John	-	-	-	-
Totals	28945-85511	128104-180555	13945-15768	170994-281834

* included in Williams Lake summary

Table 5.19

REGIONAL WATER MANAGEMENT OPPORTUNITIES

POTENTIALLY BENEFITING AREA SUMMARY
(ha)

AGRICULTURAL DISTRICT	REGIONAL DRAINAGE	REGIONAL IRRIGATION	FLOOD & STREAMBANK PROTECTION
Cloverdale	7625	6375	2410
Abbotsford	19875	1000	3910
Chilliwack	7435	1935	270
Duncan	1320	1850	100
Courtenay	100	3570	-
Salmon Arm	200	2000	-
Vernon	200	8180	-
Oliver	300	752	-
Creston	30	3450	100
Cranbrook	-	6700	-
Kamloops	-	11950	-
Williams Lake	200	3100	100
Quesnel *	-	-	-
Prince George	-	-	200
Vanderhoof	-	-	-
Smithers	-	-	-
Dawson Creek	1500	-	1000
Ft. St. John	-	-	-
Totals	38785	50762	8090

* included in Williams Lake Summary

WATER MANAGEMENT OPPORTUNITIES

Regional irrigation works represent the largest regional water management opportunity identified, with and estimated $128-180 million in potential works, serving an estimated benefiting area of just under 51,000 ha. As expected, the most of these potential works are located in the District Office areas of the Okanagan, Kootenay, Thompson and Cariboo Regions.

Regional drainage works totalling an estimated $29-86 million were identified during the study. Most of these works are in the Mainland and Island Regions.

Flood and streambank protection works totalling $14-16 million were also identified. Almost all of these works represent potential flood protection projects in the Lower Fraser Valley.

On-Farm Drainage

On-farm drainage opportunities identified during the various workshop sessions and subsequent contacts are summarized in Tables 5.20 (capital costs) and 5.21 (potentially benefiting area). Within the province, a total of approximately $40 million in on-farm drainage works has been identified, representing over 34,000 ha. Most of these potential works are in the Mainland and Island Regions, although significant on-farm drainage requirements were documented in the Kootenay and Peace Regions and also in the Cariboo, on-farm development of wetlands for forage production represents a major opportunity.

While the above estimates are considered to be substantially below the total amount of presently cultivated lands requiring

Table 5.20

ON-FARM WATER MANAGEMENT OPPORTUNITIES

ESTIMATED RANGE OF CAPITAL COSTS SUMMARY
(1984 $'s x 1000)

AGRICULTURAL DISTRICT	ON-FARM DRAINAGE	ON-FARM IRRIGATION
Cloverdale	7644	2445-13040
Abbotsford	9168	1200-6400
Chiliwack	4032	1401-7472
Duncan	4200	1590-8480
Courtenay	240	2142-11424
Salmon Arm	240	1200-6400
Vernon	240	4409-23514
Oliver	840	2131-11366
Creston	1380	2304-12288
Cranbrook	5400	4020-21440
Kamloops	600	7830-41760
Williams Lake	1880-2180	1860-9920
Quesnel *	-	-
Prince George	-	300-1600
Vanderhoof	-	300-1600
Smithers	-	300-1600
Dawson Creek	3480	-
Ft. St. John	-	-
Total	39344-39644	33432-178304

* included in Williams Lake summary

Table 5.21

ON-FARM MANAGEMENT OPPORTUNITIES

POTENTIAL BENEFITING AREA SUMMARY
(ha)

AGRICULTURAL DISTRICT	ON-FARM DRAINAGE	ON-FARM IRRIGATION
Cloverdale	6370	4075
Abbotsford	7640	2000
Chilliwack	3360	2335
Duncan	3500	2650
Courtenay	200	3570
Salmon Arm	200	2000
Vernon	200	7348
Oliver	700	3552
Creston	1150	3840
Cranbrook	4500	6700
Kamloops	500	13050
Williams Lake	3150	3100
Quensel *	-	-
Prince George	-	-
Vanderhoof	-	500
Smithers	-	500
Dawson Creek	2900	-
Ft. St. John	-	-
Total	34370	55720

* included in Williams Lake summary

such works in the province, most poorly drained lands have been farmed for many years with no such improvements being made. In considering the amount of on-farm drainage works which might be implemented over the next 5 to 10 years, it is probably more useful to look at the amount of on-farm drainage work that occurred over the past few years rather than considering the areal extent of all lands which would benefit from on-farm works.

Staff of Engineering and Soils Branches of the BCMAF estimate that for the lower Fraser Valley and Vancouver Island subsurface drainage has been installed at the rate of 600,000 to 900,000 m. over the past few years. If an average drain spacing of 15 m is assumed, the rate of on-farm drainage is equivalent to approximately 900 to 1350 ha per year, or 4500-6750 ha over the next 5 years, which is substantially below the estimate obtained from the regional inventory of these areas. It is likely that if further financial assistance were available for on-farm drainage, the rate of installation would increase somewhat.

On-Farm Irrigation

On-farm irrigation works identified during this study are summarized in Tables 5.20 and 5.21. Within the province on-farm works totalling approximately $33-178 million and representing almost 56,000 ha have were documented in the inventory compilation. While most of these potential works are located in the Okanagan, Thompson, Kootenay and Cariboo Regions, significant on-farm irrigation opportunities were also identified in the Mainland and Island Regions.

WATER MANAGEMENT OPPORTUNITIES

As with the situation outlined for on-farm drainage works, even though these totals underestimate the total on-farm irrigation opportunities within the province, it is felt that they overestimate the amount of on-farm irrigation implementation which would occur over the next 5 to 10 years. In assessing a more realistic rate of implementation of on-farm irrigation works, it is probably more valid to consider other available data.

Census data for 1970 and 1980 show that for that period the total irrigated area within the province increased by 11043 ha, from 89432 to 100475 ha, which represents an average annual increase of 1.17%. However, over the same period of time, sprinkler irrigation increased by 50283 ha, from 32423 to 82706 ha, representing an average annual increase of 9.82%. This would indicate that much of the on-farm irrigation development which has occurred over this period of time was conversion to sprinkler irrigation from surface irrigation systems.

Staff of the Engineering Branch of the BCMAF have prepared projections for increases in irrigated extent for three areas of the province as input into the preparation of strategic plans for the Thompson-Bonaparte, the Nicola and the Fraser Delta Planning Units. The projected increases, from 1983 to 1988, were 4500 ha for the Thompson, Bonaparte (31000 to 35500 ha), 3105 ha for the Nicola (11895 to 15000 ha) and 2850 ha for the Fraser Delta (9200 to 12050 ha). For the three areas combined, the projected increase totals 10455 ha, which represents an average annual increase of 3.73%. The Engineering Branch expressed the opinion that the rate of increase in irrigated area for the province would be somewhat less than for these three areas.

WATER MANAGEMENT OPPORTUNITIES

As more detailed information on the rate of installation of on-farm irrigation works was not readily available, it was assumed that on-farm irrigation would expand at the rate of approximately 3000 ha per year, or 15,000 ha over the next 5 years.

Surface Water Erosion

An additional water constraint to agricultural development which has been addressed briefly in this study is that of surface water erosion. Report Information Sheet A-10 summarizes information on an ongoing runoff water and soil erosion control demonstration project in the Lower Fraser Valley where on-farm drainage improvements are being used to help control runoff and reduce soil erosion, with very encouraging results to date. It was estimated that potentially 50,000 ha of agricultural lands in the Lower Fraser Valley could have their agricultural productive potential increased by appropriate soil conservation measures, however significantly less area (perhaps 2000-3000 ha) is currently cultivated. This was identified as a Water Management Opportunity (Sheet 2-10), but the extent was not tabulated as it was assumed that any works to overcome this constraint which might be implemented during the next 5 to 10 years would be essentially on-farm drainage works, and the areas involved would be part of the projected on-farm drainage improvements.

Low infiltration capacity soils and associated drainage problems in the Prince George and Vanderhoof Districts were identified as an opportunity (see Sheet 14-1) during the workshop program, however no estimates of the area involved were made at the Prince George workshop.

WATER MANAGEMENT OPPORTUNITIES

Subsequent to the Dawson Creek workshop, contact was made with Agriculture Canada staff currently carrying out research on surface soil erosion in the Peace Region. Although research results are preliminary and erosion prediction mapping has not yet been completed, a tentative estimate of the magnitude of the problem has been made. On existing cultivated areas, erosion problems probably occur on in excess of 250,000 ha. While much attention is placed on gully erosion because of its obvious visibility, research on sheet and rill erosion, which is much less obvious on cultivated areas because it is regularly obliterated by tillage practices, indicates that these erosional processes cause major soil losses. Soil losses to erosion in the Peace Region are estimated to average approximately 12 t/ha/year on cultivated areas with erosion potential.

In general, the technology for limiting surface erosion losses to acceptable levels is largely known, consisting of improved cultural practices such as cross slope farming, minimum tillage, better use of crop residues, and a reduction in fallowing practices.

While more research is needed into the economic consequences of adopting such practices, some initial opportunities also exist for directly addressing the constraint. Highly visible demonstration farms are needed, both to assess the practicality of soil conservation practices at a farm operating scale and to show other producers the potential benefits associated with such practices. In addition, training courses and workshops could be commenced, both for extension personnel and for producers. No estimate of the cost of such programs has been

made in this study. Further research and program definition is required before even a preliminary estimate is possible.

6

PROGRAM OPPORTUNITIES

The regional workshops, in addition to providing a basis for the identification of the water management opportunities discussed in the previous chapter, also provided a forum for much wider ranging dicussions of regional agricultural development needs, the role and performance of past federal-provincial development programs, and the perceived opportunities for future development programs. This chapter provides a summary of the main points to come out of these discussions.

STRATEGIC PLANNING

Many of the criticisms of past agricultural development programs and suggestions for future programs aired at the workshops dealt with the need for strategic planning to be carried out in advance of program implementation. Previous programs were felt to have been too broad in their scope and eligibility criteria, and too reactive in terms of projects supported, with the result that agricultural development objectives were not furthered to the greatest extent possible within available program budgets. Advance strategic planning was seen as one means of making future programs more effective.

PROGRAM OPPORTUNITIES

Such planning should address several considerations, foremost among which would be the setting of program objectives, that is, a definition of exactly what the program(s) should be designed to achieve. Such a specification of objectives would logically proceed from the general to the specific. Vague generalities (eg. "to further agricultural development in the province") are to be avoided as they do not provide any guidance to program implementation, they do not indicate why one project should be given priority over another.

Presumably general program objectives would reflect government agricultural policy. An example of a possible general goal could be "to promote agricultural self-sufficiency in the province". In a strategic planning exercise, the next step would be to define this goal more highly (does this objective relate to import substitution only?... or does it include promotion of exports?) and then to a consideration of how this goal can best be furthered (which specific commodities/markets offer the best chance of exploitation?... which regions are best placed to take advantage of such opportunities?... what manner of program assistance can best facilitate the realization of this opportunity?). This exercise would culminate in the definition of specific commodity/market/region targets which are considered to be of most interest to the program in light of its self-sufficiency goal. Such a definition would be put forward only on an initial basis, and monitored and re-considered as economic conditions change and as new information allows reassessment of opportunities.

The above self-sufficiency objective is presented only as an example, and other program objectives could be set by posing and answering critical agricultural policy questions. Many such questions were raised in discussions at the regional workshops,

including the following:

- should the program favour projects promoting new or increased production or should program efforts be equally directed to projects which seek to retain or rehabilitate existing levels of production?

- should the program play a role in facilitating inter-agency resolution of resource conflicts which affect agricultural development?

- should the program play an active role in facilitating applications in cases where opportunities have been identified but property owners have not yet inititated an approach to the program?

- should the program favour assistance being directed to full-time, commercial farmers?

- should the program favour assistance to ALR lands?

- should program assistance be tied to applicant cooperation or compliance relative to other agricultural objectives (for example, should a farmer's eligibility for program assistance on a drainage project be tied to compliance with soil conservation measures on his farm?)?

In addressing these and many other policy issues, it will be possible to formulate a set of general program objectives from which can flow specific funding directions and funding targets as a function of commodity groups, regions, and types of program assistance (off-farm infrastructure, on-farm infrastructure, processing/packing facilities, market

development assistance etc.). The definition of these targets, to be monitored regularly and revised as changing economic conditions dictate, would form the basis for initial program definition and for screening of applications made to the program.

RESEARCH FOR FUTURE PROGRAM DEFINITION

Such a strategic planning exercise as suggested above requires considerable data and will take time to put in place. In order to allow the program to commence as soon as possible, initial targets should be set in areas where there is widespread agreement and support, and planning studies commenced to provide better definition of other areas. In addition to the obvious requirement for studies of marketing possibilities and regional production capabilities/constraints, work is also required related to the types of assistance programs to be offered, particularly in those areas where perceived project opportunities have not been highly defined or little past project experience is available. Some examples, relative to the work carried out in this study on water management opportunities, are as follows:

- the potential for a soil conservation program oriented, in particular, to the fine-textured soils of the Mainland, Omineca and Peace Regions: more work is needed on the extent of the existing soil erosion problem, the type of soil conservation practices needed to curtail soil erosion, and especially on the practicality (costs and benefits) of such practices. While sufficient work has been carried out on this constraint to commence an initial soil conservation program, further work is needed to determine the magnitude, extent and

format of a more complete program.

- the potential for an inter-agency program of wetland development oriented, in particular, to the Cariboo Plateau: research is needed into the status, existing use and potential use of wetlands, the main types and zones of resource conflict between users, and the opportunities for resource tradeoffs between users and/or joint development by users. From this work, the type of assistance program which would best facilitate defined agricultural development opportunities could be identified.

- the potential for an inter-agency program of watershed planning, oriented to watersheds where surface flows are largely or fully recorded, such as in much of the Okanagan Region: research is needed into the status and nature of existing water use in typical watersheds, the potential for rationalization of water use and improvements in use efficiency, and the opportunities for joint development by users, including agricultural users. From this work could come the definition of a program which could facilitate further development in such situations.

For these potential programs, and others like them that have not been fully explored to date, there is a need for further study before full-scale assistance programs are offered. If such studies identify or confirm program opportunities, further work in the form of pilot projects should be considered. A decision for a larger program could then be made based on the results of such pilot projects.

PROGRAM OPPORTUNITIES

INTEGRATION WITH OTHER PROGRAMMING

Considerable workshop discussion focussed on the desirability of making on-farm infrastructural works such as irrigation distribution sytems and internal drainage works eligible for assistance under any future federal-provincial agricultural development program. While, in general, it was considered desirable to assist such works, several participants indicated that the present ALDA program appeared to work very well in this regard. The positive features of the ALDA program were indicated to include:

- the relative simplicity of the application and approval process

- the lack of requirement to carry out a benefit-cost analysis

- the fact that all of the works are financed through the program, compared to the farmer having to arrange financing for a share of the works

- the requirement for the applicant to submit a plan of the works for technical approval

Rather than have two parallel assistance programs operating in this area, it was suggested by several workshop participants that the two programs be integrated, or in some fashion rationalized so that they were complementary. This could take one of several forms:

- make the list of on-farm works eligible for assistance under the two programs mutually exclusive. On-farm irrigation and drainage works, for example could be included under the

federal-provincial program, with land clearing remaining under ALDA.

- bring the ALDA program fully into the federal-provincial program and augment ALDA funding with additional federal-provincial funds.

- retain ALDA outside of the federal-provincial program with responsibility for all on-farm assistance.

Regardless of the format chosen, it was suggested by many participants that any on-farm works program retain the ALDA approach to soft loan financing rather than employing capital grants.

FUNDING CRITERIA

Considerable workshop discussion centred on the past use of benefit-cost analysis as the almost exclusive means of making technical recommendations for funding decisions under past federal-provincial programs. While it was recognized that some basis for measuring potential projects against a common yardstick is needed in a capital assistance program where the available projects far outstrip the available funding, many criticisms of the way benefit-cost analysis was used in past programs were made. A common theme of criticism went as follows:

- agricultural enterprises, with few exceptions, are not highly profitable ventures and do not return competitive financial rates of return to investment.

- the past requirement for projects to return a 10% per annum real (inflation-discounted) rate of return to total capital investment represented an unattainable and unrealistic criterion for most projects contemplated.

- this unrealistic standard resulted in inconsistent approaches to project benefit evaluations and often led to evaluations that were very optimistic in their projections of the timing, nature and degree of cropping benefits attributable to the project.

- these optimistic projections have not been borne out and, in hindsight, it is felt that inconsistency in benefit evaluations have resulted in a less than optimal distribution of program assistance.

If benefit-cost criteria are to be useful in assessing the desirability of individual projects, standards that are more in line with industry performance should be considered, and attempts should be made to ensure consistency in benefit evaluation, such that evaluations employ realistic projections of future land use with and without the project.

MAINTENANCE AGREEMENTS

Several workshop participants expressed concern over the lack of project maintenance after the project capital works were put in place, despite program agreements with the local authority regarding project maintenance. In some cases, it is felt that this situation has led to some degree of potential project benefits not being realized. It was generally felt that if such situations were to be avoided in the future, more formalized

arrangements are needed at the time that program capital assistance is awarded. A condition of the award could require, for example, that the local authority, in addition to arranging for its local share of the capital works, establish a fund from which required maintenance expenses could be met. Withdrawals from this fund would be regulated by the implementing program, or its successors, and would operate on an endowment basis, with only a portion of the accumulated interest being withdrawn, except under extraordinary circumstances.

PROJECT MONITORING

Considerable workshop discussion centred on the use of project monitoring to improve program implementation. Monitoring could be used in two major ways. Firstly, for completed projects, it could be used as the basis for identifying additional constraints to the full realization of project benefits and allow the design of potential program assistance which would address these constraints. Secondly, project monitoring could be used as feedback to either improve the design or to provide a basis for a more critical examination of similar projects being considered for assistance.

Monitoring should be considered, not only for all projects assisted in any future federal-provincial agricultural development program, but also for all projects funded under the past agreement which are similar to projects to be assisted under any new program.

Two related aspects to proposals for project monitoring involve project staging and pilot projects. In many cases, it was felt that past funding decisions could have been improved had

specific projects been staged, or had new types of projects been tested at a pilot project level. The results of initial project stages, or pilot projects, could then be monitored before funding commitments are made on a larger scale.

REFERENCES

B.C. Environment and Land Use Committee Secretariat. 1976. Agricultural Capability in British Columbia. ARDA Project No. 89077. Victoria: BCELUC Secretariat.

Select Standing Committee on Agriculture. 1978. Inventory of Agricultural Land Reserves in British Columbia. Victoria: Queen's Printer.

Talisman Land Resource Consultants. 1979. B.C. Land Inventory Report. Victoria: Queen's Printer.

Talisman Land Resource Consultants. 1979. Status Report on the Fraser River Flood Control Program. Victoria: BCMAF, ARDA Branch.

Talisman Land Resource Consultants. 1982. Potential Irrigation Demand in the Nechako and Bulkley River Valleys. Vancouver: Envirocon Ltd.

Talisman Land Resource Consultants. 1983. Kobes Creek Deferred Planning Area. Fort St. John: BCMLPH.

Talisman Land Resource Consultants. 1983. Fort St. John North Deferred Planning Area. Fort St. John: BCMLPH.

Talisman Land Resource Consultants. 1983. Fort Nelson Deferred Planning Area. Fort St. John: BCMLPH.

Talisman Land Resource Consultants. 1984. Agricultural Land Use in the Cariboo Region. Victoria: BCMLPH.

APPENDIX A
TERMS OF REFERENCE

A.R.D.S.A. PROJECT 271322 - Subproject #4

WATER CONSTRAINTS IMPACTING AGRICULTURAL DEVELOPMENT

TERMS OF REFERENCE

INTRODUCTION

Water plays a significant role in the production of agricultural crops in the province. The topography, climate and soils affect the way in which water affects agricultural development and production, or as an essential input to new opportunities.

The manner in which water affects agricultural land takes many forms; water deficits, surplus water, surface and stream bank erosion, flooding, etc. While many site specific reports on each of these areas have been prepared by various government agencies or consultants for government agencies, no single report identifies the nature and extent of the problem of water effects on agricultural development and production on a province wide basis. As such, there is no real indication of the magnitude of the various water related problems in the province in order to identify and develop programs to aid in overcoming the problems.

PURPOSE

To prepare a comprehensive overview of the type, nature and extent of water-related constraints on agricultural land throughout the province.

To prepare a compendium of all reports prepared by or for government agencies on drainage, dyking, erosion, irrigation and water storage related to agricultural development or production.

SCOPE

Emphasis will be placed on the identification and examination of the water constraints on agricultural development and production for each of the eighteen Ministry of Agriculture and Food Districts.

APPROACH

The study will be conducted in two phases:

PHASE I: WATER CONSTRAINT LITERATURE

Many individual site specific reports have been prepared by the Engineering Branch, Ministry of Agriculture and Food and the Water Management Branch, Ministry of Environment, or prepared by

consultants for the above mentioned agencies and for A.R.D.S.A. This phase of the study involves a literature search and requires the preparation of a compendium of these reports. Information to be reported to include:

a) Title of the report
b) Location of study area
c) Brief summary of the report.

This information will be presented in the following format:

a) by district
b) by type of project, i.e., drainage, dyking, irrigation, etc.

This information will provide a starting base for Phase II.

The Ministry will approach all relevant agencies to provide lists of reports and project proposals. In many cases agencies will be requested to provide a synopsis of each according to a standard format.

PHASE II - INVENTORY OF WATER CONSTRAINTS

The study will provide a comprehensive provincial overview of the type, nature and extent of water constraints in each District. The report will identify the quantity of land affected, the productive potential of these lands, and provide a 'ball park' estimate of the benefits and costs of alleviating and/or remedying these constraints.

The types of water constraints to be considered are:

a) drainage
b) flooding and land subject to flooding
c) erosion (surface and streambank)
d) irrigation
e) water storage

The inventory will utilize information contained in Phase I and will depend on workshops arranged by the Ministry of Agriculture and Food, including representatives from improvement districts and other government agencies to provide primary information for the inventory. These workshops will be used to identify specific areas within Agricultural Districts that are constrained by water.

The Farmland Resources Branch will coordinate the Regional Workshops for primary data collection. This primary data will then

be utilized by the consultant to perform more detailed analysis with respect to determining the quality and productive potential of the lands, the on-farm/off-farm improvements and the cost of improvements. This should be presented in a manner that will allow government to identify some opportunities for development and serve as a preliminary basis for establishing priorities.

DOCUMENTATION

The study will produce a report documenting the following:

Phase I: Water Constraint Literature

For each Agricultural District:

- the type of water constraint study
- the title of the report
- who prepared the report and who it was prepared for
- where a copy of the report can be obtained
- location of the study area
- areal extent of study area
- brief summary or abstract of the report
- whether the proposal was or was not implemented

Phase II: Inventory of Water Constraints

The inventory of water constraints will document, by Agricultural District, tables based on the following:

- the type of water constraint
- the areal extent of the constraint and more specific locations, where possible
- the productive potential of the land affected by the constraint (relate to C.L.I. agricultural capability system)
- the non-water constraint/limitation/restriction which affect the realization of the productive potential
- the requirement for and type of on-farm or off-farm improvements to overcome the constraint
- the cost estimates of improvements required.

An overview of the provincial circumstances should be presented. Eight copies of the draft reports will be submitted for review.

PROJECT REVIEW AND SUPERVISION

The project review will be coordinated by the Farmland Resoures Branch of the Ministry of Agriculture and Food prior to submission to A.R.D.S.A., Part I Technical Subcommittee. The review committee will be established with representatives of the following to be appointed to the review committee:

Ministry of Agriculture and Food:

Farmland Resources Branch, Chair
A.R.D.A. Branch
Engineering Branch

Ministry of Environment:

Water Management Branch
Terrestial Studies Branch
Planning & Assessment Branch

Agriculture Canada

An initial meeting of the committee and the consultant will be held to discuss the expectations of the study. The Ministry of Agriculture and Food will assume responsibility for the organization of regional workshops to ensure the consultant has access to relevant personnel. Further meetings will be at the discretion of the Chairman, or at the request of the consultant.

The consultant will file, on a monthly basis, reports on the progress of the study and identification of problems or delays.

The first draft of the report will be provided by July 27, 1984. Reviews of the draft will be completed in a three week period. A final draft report will be submitted by September 1, 1984. Any review comments will be forwarded to the consultant by September 17, 1984, with the final draft report submitted to the A.R.D.S.A. Part I Technical Subcommittee on or before October 1, 1984. Under no circumstances will the final draft report be submitted later than this date.

COST

The cost of the study is not to exceed $24,500.00. The Ministry of Agriculture and Food will assume the cost of the regional workshops, except for time and travel costs of consultants.

CONTENTS OF PROPOSAL

1. Outline of qualifications of firm in terms of relevant experience;

2. Curricula Vitae of proposed project staff and applicable per diem rates;

3. Presentation of proposed approach and methodology;

4. Proposed work plan and proposed staff assignments in person days; and

5. Project budget breakdown against the workplan indicating:
   - total value of fees
   - total estimated value of expenses
   - total cost of the proposed study
   - estimated time required for completion of study from date of notification.

APPENDIX B
REPORT INFORMATION FORM

WATER CONSTRAINTS STUDY REPORT INFORMATION SHEET

AGRICULTURAL DISTRICT(S)_____

NTS GRID REFERENCE(S)_____

_____

==========

NAME/PHONE NO. OF REPORT REVIEWER:_____

BRANCH/MINISTRY:_____

TITLE OF REPORT:_____

_____

PREPARED FOR:_____

PREPARED BY:_____

AVAILABLE FROM:_____

TYPE(S) OF WATER CONSTRAINTS/DEVELOPMENTS ADDRESSED IN REPORT:
circle one or more of following:

1. on-farm drainage
2. regional/off-farm drainage
3. hydrology/water investigation
4. irrigation storage
5. irrigation supply works
6. on-farm irrigation
7. shoreline/bank erosion
8. surface erosion
9. flooding/dyking
10. other_____

STUDY LEVEL OF DETAIL (circle ONE of the following):

1. background study or general inventory only
2. overview regional (or basin) planning study
3. project overview or pre-feasibility study
4. project feasibility study
5. project design
6. other_____

LOCATION OF STUDY AREA (describe briefly, append a page-size location map of a suitable scale, insert agricultural district and NTS grid references above):_____

_____

_____

INVENTORY OF WATER CONSTRAINTS (summarize findings for those areas for which inventory information is presented but no specific projects are defined and assessed. Specific project benefiting areas are to be described in a following section):

_____

_____

_____

_____

_____

_____

(over)

NOTE: THE REMAINDER OF THIS SHEET IS TO BE FILLED IN ONLY IF REPORT DESCRIBES A SITE-SPECIFIC PROJECT; OTHERWISE OMIT

PROJECT NAME:_____

ENGINEERING DESCRIPTION (indicate critical engineering parameters impacting cost estimates, eg. pumped or gravity irrigation, pumping height, distance from source to benefiting area, pumped or gravity drainage discharge, outlet suitability, storage magnitude, length of eroding streambank etc. Use 1 description sheet per project):_____

_____

_____

_____

_____

_____

_____

_____

_____

PROJECT VIABILITY

1. benefiting area: indicate the extent of the benefiting area (arable land only) in hectares_____ha; in hectares/year for bank erosion projects _____ha/yr
2. describe the nature of cropping benefits attributable to the project (in terms of BCLI ratings, yield increases, shifts in cropping patterns, maintained production levels, etc.):_____

   _____

   _____

   _____
3. total project (off-farm) capital costs: $_____
4. cost estimates as of which year?_____
5. report conclusions reached regarding project viability:

   _____

   _____

   _____

NOTES ON ADJACENT AND/OR RELATED PROJECT (if applicable)_____

_____

_____

PRESENT STATUS OF PROJECT (if known):_____

_____

_____

APPENDIX C
WATER MANAGEMENT OPPORTUNITY FORM

WATER CONSTRAINTS STUDY WATER MANAGEMENT OPPORTUNITIES SHEET__

AGRICULTURAL DISTRICT_____

NTS GRID REFERENCE_____

==========

TYPE OF CONSTRAINT:_____

_____

AREA CONSIDERED/LOCATION:_____

_____

AREAL EXTENT OF POTENTIALLY BENEFITING AREA:_____

_____

PRODUCTIVE POTENTIAL WITH WATER CONSTRAINT_____

_____

_____

PRODUCTIVE POTENTIAL WITHOUT WATER CONSTRAINT_____

_____

_____

NON-WATER CONSTRAINTS AFFECTING AGRICULTURAL OPPORTUNITY:

1. conflicting land use:_____
2. land status/ownership:_____
3. jurisdictional conflict:_____
4. infrastructural (access, power):_____
5. economics:
   a. project not viable_____
   b. project viable, financing not available_____
   c. project viable, but subsidy funds needed_____
6. uncertainty/risk: project viability unknown_____
7. other constraint(s):_____

WATER MANAGEMENT OPPORTUNITY (describe):_____

_____

_____

_____

COSTS OF IMPROVEMENTS (relative to completed projects):

		estimated
1. on-farm drainage costs	H M L	_____
2. regional drainage costs	H M L	_____
3. irrigation storage costs	H M L	_____
4. irrigation supply costs	H M L	_____
5. on-farm irrigation costs	H M L	_____
6. erosion protection costs	H M L	_____
7. dyking costs	H M L	_____
total project costs		_____

APPENDIX D
ARDSA PART III PROJECTS

ARDSA PART III PROJECTS - CONSTRUCTED OR UNDER CONSTRUCTION (AUGUST 1984)

Project No.	Name of Project	No. Acres	No. Landowners	Approved Cost	ACTUAL COSTS 1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	Final Cost	Per Acre
IRRIGATION PROJECTS													
271003-1	Farleigh Lake - (1)	12	4	6,000		6,000						6,000	$ 500
271003-2	Farleigh Lake - (2)	16	5	5,200				4,505				4,505	$ 282
271003-3	Farleigh Lake - (3)	28	9	20,000						19,296	861	20,157	$ 720
271100	Chinook Cove	216	4	111,600	57,014	1,932						58,946	$ 273
271102	Wynndel	790	190	650,000	472,112	133,905	16,278					623,295	$ 789
271106	McKinney Road	319	6	361,000		14,823	203,553	92,842	32,630	17,152	11,000*	372,000*	$1,166
271108	St. Mary's Prairie	525	8	498,808		215,279	210,375	5,971				431,625	$ 822
271109	Big Bar Ranches	410	4	187,050		28,089	125,446	26,486	2,029			187,050	$ 456
271112	O'Connor Lake	400	2	232,000			177,548	94,517	1,396			229,781	$ 575
271113	Basque Vineyards	145	5	147,910		124,437	23,455					147,892	$1,020
271115	Paxton Lake	107	4	62,800			28,446	32,821				61,266	$ 367
271116	Chase I. D.	640	30	57,768			39,277					39,277	n/a
271117	Heffley I. D.	1200	13	100,000			40,058	24,216	1,463			65,737	n/a
271124	VID - von Keyserlingk	447	10	698,220				50,823	553,798	52,837	40,762*	698,220	$1,562
271125	Barnes Lake	940	4	225,000				180,000	20,712	24,286		224,998	$ 240
271133	Lalwissin-McGillivray	523	3	525,000					68,501	409,499	49,250*	527,250	$1,008
271134	SEKID - Hydraulic Creek	4350	350 +/-	87,000					84,845	2,154		86,999	n/a
271135	North Thompson I.R.	500	12 +/-	272,665					203,779			203,779	$ 408
271136	SEKID - Brouns Lake Dam	4350	350 +/-	134,560						85,000	50,061	137,061	n/a
271137	Covert Farms	134	3	147,000							147,000*	147,000*	$1,097
271141	Okanagan Mission W.U.C.	198	15	333,000							333,000*	333,000*	$1,682
271142	Osoyoos Indian Band	526	n/a	777,200						183,416	396,584*	580,000*	$1,102
271143	Stone-Chilco Irrigation	900	n/a	290,000							290,000*	290,000*	$ 322
271145	Pitt Meadows/Pitt Polder	6000	160	2,000,000							2,000,000*	2,000,000*	$ 333
DRAINAGE PROJECTS													
271004-1	Upper Deep Creek	400	3	36,000		33,714						34,715	$ 87
271004-2	Malakwa	116	5	12,000		10,112	1,054					11,795	$ 102
271004-3	Grindrod	134	7	22,000		15,157	4,693					19,850	$ 148
271004-4	Oliver No. 18 Road	42	9	67,400			14,366	48,699	3,519			66,584	$1,585
271004-5	Grindrod - N. Enderby Rd.			26,950					20,621			20,621	$1,031
271004-6	Meier Drainage	82	4	21,500						21,500		21,500	$ 262
271004-7	Rumble Creek	40	3	8,000									
271101	Kent-Hammersly	1025	40 +/-	240,800		146,845	53,155	40,800				240,800	$ 235
271105	Pemberton	7500	40 +/-	3,540,000		296,162	935,358	840,979	541,567	796,959	2,135	3,413,160	$ 455
271107	Old Logging Ditch	641	20	617,000				460,001	158,091			618,092	$ 964
271110	Nicomen Island	594	11	328,200					328,756			328,756	$ 553
271114	Glen Valley	2200	75	222,500			85,000	244,759				244,754	$ 111
271118	Tod Creek	70	5	200,000			25,043	118,199	21,803	24,488		189,533	$2,708
271120	East Chilliwack	3054		2,550,000				417,849	787,677	618,485	985,989*	2,810,000*	$ 920
271127	Matsqui - Sim Road	260	5	50,000					50,000			50,000	$ 192
271128	Sliammon I.R. #8	1800		1,840,667				677,216	509,428	46,217		1,222,860	$ 679
271129	Delta-Crescent Slough	1300		587,000				164,607	319,351	105,162		589,120	$ 453
271130	Miami Slough	1100		343,000						343,000		343,000	$ 312
271131	Burrows Ditch	1062	40+/-	1,344,000						682,795	110,000*	792,795*	$ 746
271132	Semenos - Richards Creek	560	22	425,000					65,601	328,424	60,975*	455,000*	$ 812
271139	Pitt Meadows Drainage	5627	191	4,003,000						1,305,919	2,697,081*	4,003,000*	$ 712
271144	Sumas Prairie Drainage	1580	182	1,133,000						57,288	1,075,000*	1,133,000*	$ 717

*Estimated

POOR

QUALITY

ORIGINAL